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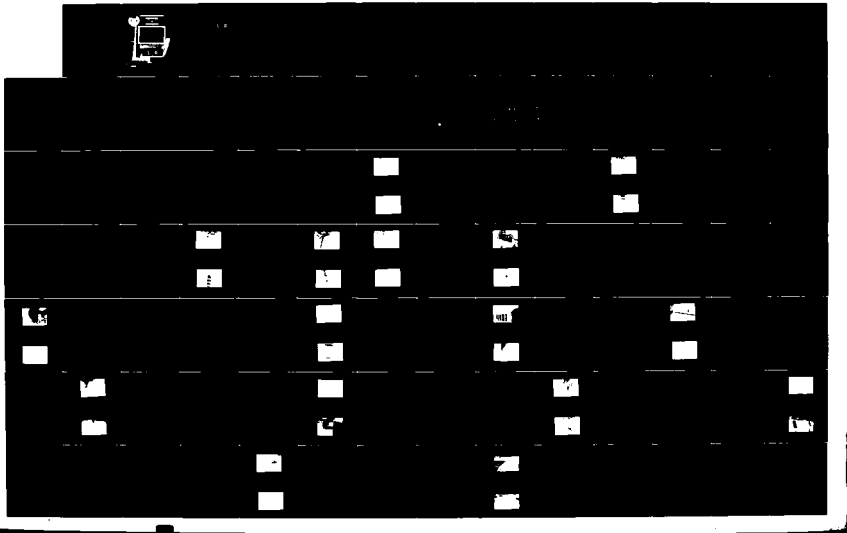

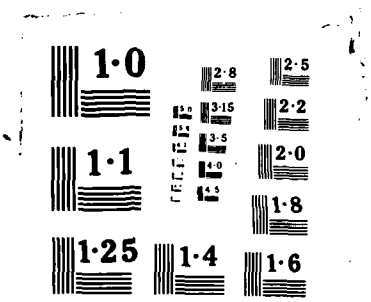
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UNDERWATER FACILITIES INSPECTIONS AND ASSESSMENTS AT

NAVAL COASTAL SYSTEMS CENTER PANAMA CITY, FLA.

FPO-1-85-(17) JUNE 1985

PERFORMED FOR:

OCEAN ENGINEERING AND CONSTRUCTION PROJECT OFFICE
CHESAPEAKE DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
WASHINGTON, D. C. 20374

UNDER:

CONTRACT N62477-85-D-0083
TASK 1

BY:

OGLETREE ENGINEERING, INC.
CORPUS CHRISTI, TEXAS 78413

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16. SUPPLEMENTARY NOTATION

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FIELD	GROUP	SUB-GROUP

18. SUBJECT TERMS (Continue on reverse if nec.)
Underwater inspection, Naval Coastal Systems Center Panama City, FLA

19. ABSTRACT (Continue on reverse if necessary & identify by block number)
The objective of this inspection was to generate a baseline underwater condition survey of specified elements of structures at the Naval Coastal Systems Center, Panama City, Florida. Concrete wood and steel structures of various ages were included in the inspection. (Con't)

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BLOCK 19 (Con't)

A scheduled inspection program should be established to monitor structural conditions. Frequencies of inspections should vary according to the type of construction and requirements of each facility.

Facilities inspected and a brief condition assessment follows:

Pier 136: Timber piles with concrete encasements. Concrete encasements are extensively eroded, exposing timber with severe marine borer (Limnoria) infestation. Structure is very unstable, 33% of the piles have little or no capacity remaining. Borer infestation is active and further deterioration is continuing. Pier should be repaired or rebuilt.

Bulkhead 146: Steel sheet piles with concrete cap. West dock steel is in virtually new condition with coating intact. Concrete cap has very poor, soft material underwater, improving toward upper portion of cap. Some reinforcing steel is exposed. South Dock has numerous patches on the steel sheet piles. Steel section loss is typically not severe but further complete penetrations are unpatched. East Dock has numerous holes through the steel, usually near the concrete cap. Other holes were found between 10 and 15 feet below the waterline. Active fill loss was noted. Overall steel section loss is not severe.

Bulkhead 358: Steel sheet piles with concrete cap, generally in excellent condition. Active pitting of the steel is in early stages.

Marina 311: CCA treated timber piles in excellent condition. No sign of borer activity was detected. Some washout occurring beneath adjacent concrete slab.

Pier 295: CCA treated timber piles in excellent condition. No sign of borer activity except in untreated fender members.

Pier 227: CCA treated timber piles in excellent condition. No sign of borer activity except in untreated fender members.

Monorail 224: Two creosote treated timber piles. Active marine borer infestation detected. Structural integrity is not significantly impaired at this point, but conditions should be promptly stabilized.

Pier 170: Creosote treated timber piles in fresh water pond. Underwater, the timber is in excellent condition. Some top rot is occurring in exposed pile tops. Steel I beams have areas of severe corrosion.

Pontoon Barge: Steel pontoons have severe corrosion pits, in some cases completely penetrating the steel. Overall section losses are insignificant.

Seawall: Steel sheet piles with concrete cap and concrete encased batter piles. General condition is very good. Structural repairs to batter piles appear to be well done and effective. Steel appears to have been re-coated. Coasting is beginning to break down in isolated areas, especially around the interlocks. Steel section losses are insignificant.

Pier 368: Precast concrete structure. All components are in excellent condition.

EXECUTIVE SUMMARY

The objective of this inspection was to generate a baseline underwater condition survey of specified elements of structures at the Naval Coastal Systems Center, Panama City, Florida. Concrete, wood and steel structures of various ages were included in the inspection.

A scheduled inspection program should be established to monitor structural conditions. Frequencies of inspections should vary according to the type of construction and requirements of each facility.

Facilities inspected and a brief condition assessment follows:

FACILITY	CONDITIONS ENCOUNTERED
Pier 136	Timber piles with concrete encasements. Concrete encasements are extensively eroded, exposing timber with severe marine borer (Limnoria) infestation. Structure is very unstable, 33% of the piles have little or no capacity remaining. Borer infestation is active and further deterioration is continuing. Pier should be repaired or rebuilt.
Bulkhead 146	Steel sheet piles with concrete cap. West dock steel is in virtually new condition with coating intact. Concrete cap has very poor, soft material underwater, improving toward upper portion of cap. Some reinforcing steel is exposed.

FACILITY	CONDITIONS ENCOUNTERED
Bulkhead 146 Cont'd.	South Dock has numerous patches on the steel sheet piles. Steel section loss is typically not severe but further complete penetrations are unpatched. East Dock has numerous holes through the steel, usually near the concrete cap. Other holes were found between 10 and 15 feet below the waterline. Active fill loss was noted. Overall steel section loss is not severe.
Bulkhead 358	Steel sheet piles with concrete cap, generally in excellent condition. Active pitting of the steel is in early stages.
Marina 311	CCA treated timber piles in excellent condition. No sign of borer activity was detected. Some washout occurring beneath adjacent concrete slab.
Pier 295	CCA treated timber piles in excellent condition. No sign of borer activity except in untreated fender members.
Pier 227	CCA treated timber piles in excellent condition. No sign of borer activity except in untreated fender members.
Monorail 224	Two creosote treated timber piles. Active marine borer infestation detected. Structural integrity is not significantly impaired at this point, but conditions should be promptly stabilized.

FACILITY	CONDITIONS ENCOUNTERED
Pier 170	Creosote treated timber piles in fresh water pond. Underwater, the timber is in excellent condition. Some top rot is occurring in exposed pile tops. Steel I beams have areas of severe corrosion.
Pontoon Barge	Steel pontoons have severe corrosion pits, in some cases completely penetrating the steel. Overall section losses are insignificant.
Seawall 171	Steel sheet piles with concrete cap and concrete encased batter piles. General condition is very good. Structural repairs to batter piles appear to be well done and effective. Steel appears to have been re-coated. Coating is beginning to break down in isolated areas, especially around the interlocks. Steel section losses are insignificant.
Pier 368	Precast concrete structure. All components are in excellent condition.
Landing Craft Ramps	Ramp #1 is new and in excellent condition. Ramp #2 showns signs of shoreline erosion but the problem appears to be minor and controllable by placement of sacks of premixed concrete or precast panels.

NAVAL COASTAL SYSTEMS CENTER
PANAMA CITY, FLORIDA

EXECUTIVE SUMMARY TABLE

FACILITY	YEAR BUILT	TOTAL NO. OF PILES/ LIN. FT. OF BULKHEAD	SIZE LXW (FT.)	STRUCTURES/MATERIAL	RECOMMENDAT
Pier 136	1957	36/-	85 x 20	Creosote treated timber piles with concrete encasements.	1) Limit Loading 2) Repair or repla
Bulkhead 146	1953-83	-/2892	2892	Steel sheet piles	1) Evaluate cathod 2) Patch existing
Bulkhead 358	1980	-/818	818	Steel sheet piles	1) Install cathodi
Marina 311	1973	100/-	339 x 6	CCA treated timber piles	1) Reinspect in th 2) Stabilize slope concrete slab.
Pier 295	1966*	16/-	70 x 5	CCA treated timber piles	1) Reinspect in th
Pier 227	1956*	12/-	55 x 5	CCA treated timber piles	1) Reinspect in th
Monorail 224	1963	2/-	23 x 15	Creosote treated timber piles	1) Install PVC bar
Pier 170	1955	18/-	120 x 12	Creosote treated timber piles	1) Repair top rot structural "I"
Pontoon Barge	NA	12 pontoons	39 x 26	7 x 5 x 5, sheet steel pontoons	1) Fill pontoons w
Seawall 171	1955	38/590	590	Steel sheet piles Concrete encased lateral support piles.	1) Reinspect in fi
Pier 368	1982	68/-	291 x 80	16" square concrete piles	1) Reinspect in si
Landing Craft Ramps 1 & 2		-/400	400	Concrete slab and riprap	1) Maintain shor needed.

*Appear to be rebuilt

Note: All piers should be reinspected in six years unless otherwise noted.

VAL COASTAL SYSTEMS CENTER
PANAMA CITY, FLORIDA

EXECUTIVE SUMMARY TABLE

IRES/MATERIAL	RECOMMENDATIONS	EST. COST OF RECOMMENDATIONS (THOUSANDS)**
:e treated timber ;ith concrete ents.	1) Limit Loading 2) Repair or replace pier	$ 90 - 150
;heet piles	1) Evaluate cathodic protection system 2) Patch existing corrosion pentrations	$ 53
;heet piles	1) Install cathodic protection system	$ 75
eated timber piles	1) Reinspect in three years. 2) Stabilize slope beneath adjacent concrete slab.	$ 5
eated timber piles	1) Reinspect in three years.	-
eated timber piles	1) Reinspect in three years.	-
te treated timber	1) Install PVC barrier wraps.	$ 1
te treated timber	1) Repair top rot in piles, paint structural "I" beams.	$ 6
x 5, sheet steel ns	1) Fill pontoons with flotation	$ 29
sheet piles te encased lateral t piles.	1) Reinspect in five years.	-
uare concrete piles	1) Reinspect in six years.	-
te slab and riprap	1) Maintain shoreline protection as needed.	-

** Costs refer to new construction or repair.

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This engineering inspection and report was performed under the Underwater Inspection Program of the Ocean Engineering and Construction Project Office, Chesapeake Division (FPO-1), Naval Facilities Engineering Command.

The project was performed by Ogletree Engineering, Inc., Engineering Consultants, Corpus Christi, Texas under contract N62477-85-D-0083, Task No. 1.

1.1 CONTRACT TASK DESCRIPTION

The contract task required engineering services for an underwater inspection and evaluation of structural members supporting the waterfront facilities at the Naval Coastal Systems Center, Panama City, Florida. The contractor was to supply personnel and equipment to:

A. perform designated levels of examination; take measurements, provide documentation and photographs, and

B. prepare this report.

The objective was to provide a general baseline underwater condition survey from which immediate maintenance needs could be estimated and future needs could be projected.

1.2 REPORT CONTENT

This inspection report includes background information, objectives, procedures, results, evaluations, recommendations, drawings, and photographic documentation of conditions found.

The contents were derived from:

A. Drawings and information provided by the Naval Coastal Systems Center and the Chesapeake Division, Naval Facilities Engineering Command.

B. Data collected during the field inspection at the Naval Coastal Systems Center.

C. Engineering calculations, estimates, judgements and assessments applied to the facilities.

This section provides a general description of the Naval Coastal Systems Center, Panama City, Florida. The information was obtained from the Naval Coastal Systems Center Master Plan and from conditions observed during the inspection.

2.1 LOCATION OF ACTIVITY

The Naval Coastal Systems Center is located in Panama City, Florida on 657 acres of land along St. Andrews Bay near the Gulf of Mexico. The installation consists of two parcels of land, separated by Alligator Bayou, with a total of approximately two miles of coastline (See Figures 1 and 2).

The NCSC is the principal Navy research, development, testing, and evaluation (RDT&E) center for the application of science and technology to coastal region military operations. The activity was originally commissioned on September 1, 1945.

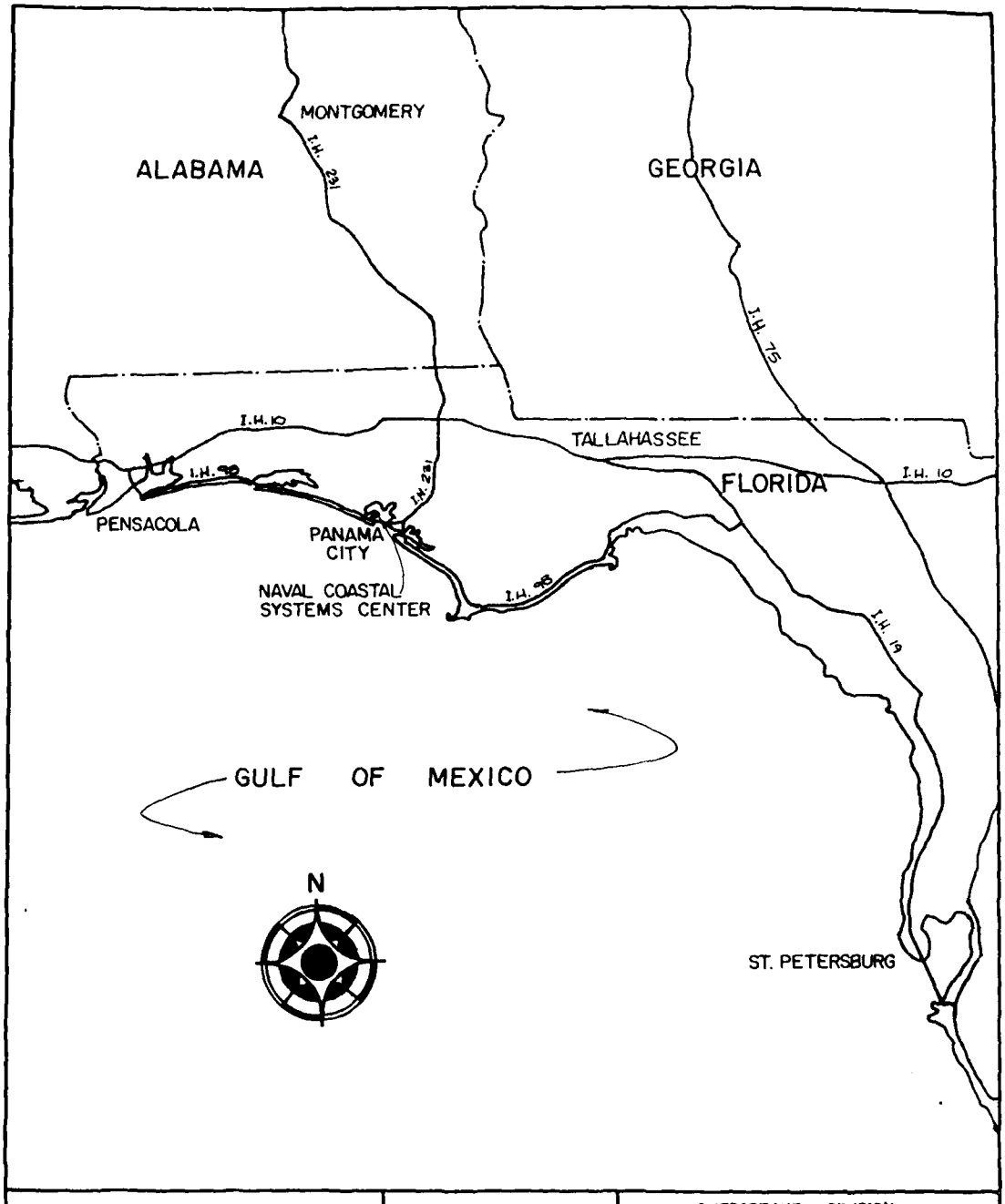
2.2 EXISTING WATERFRONT FACILITIES

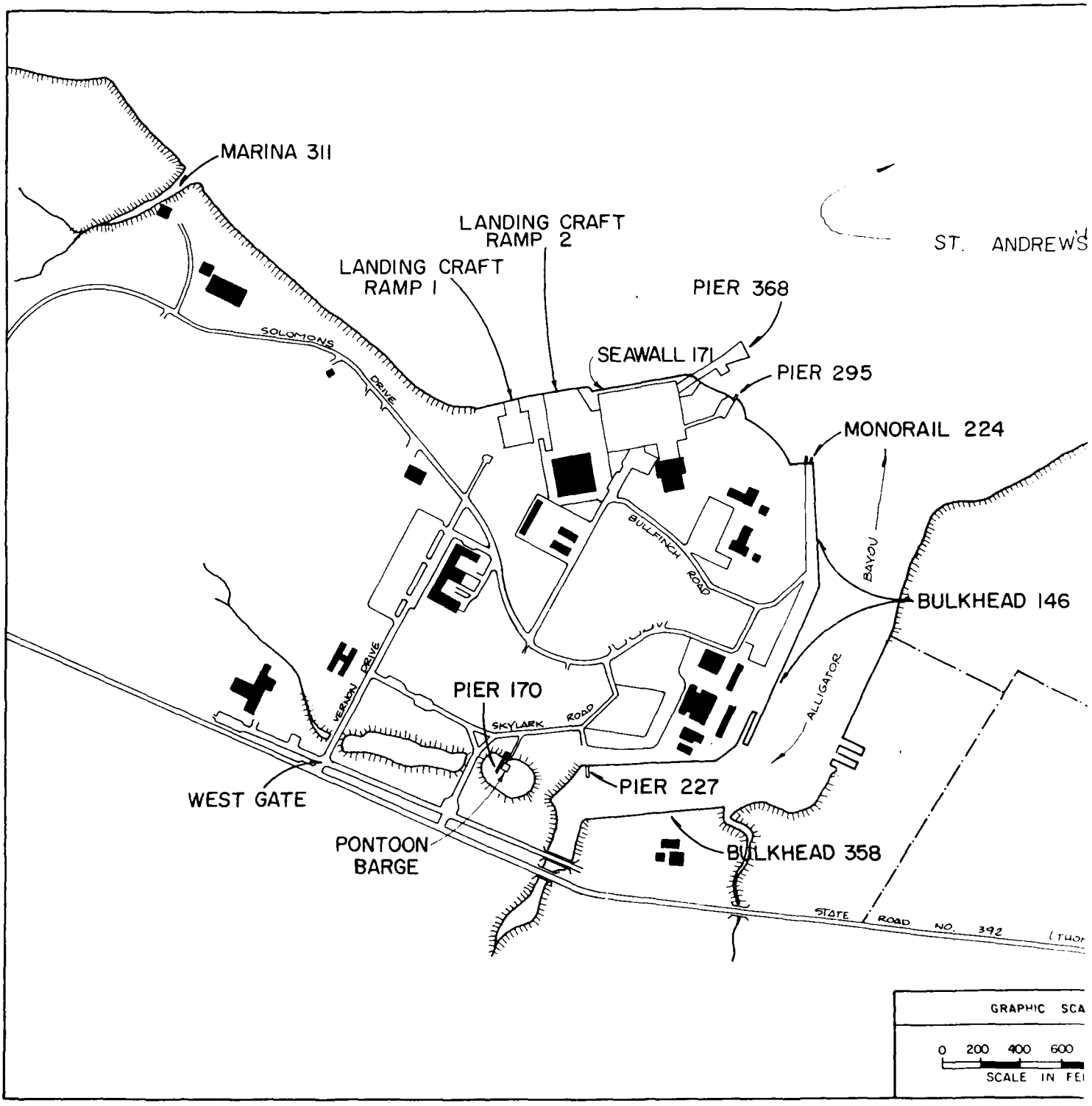
The appurtenant waterfront structures provide facilities for shoreline protection, small craft mooring and servicing, and other support activities related to development of inshore and coastal technology.

Most waterfront structures were built in the 1950's and 1960's. Timber, concrete and steel piles and sheet piles were all utilized for construction of the various facilities.

2.3 CLIMATE

Panama City's climate is characterized by mild winters with hot and humid, but breezy, summers. In January, the mean daily minimum temperature is 46°F with a maximum of 63°F. In July, the


MONTGOMERY
I.H. 231
ALABAMA
GEORGIA
I.H. 75
I.H. 10
TALLAHASSEE
I.H. 10
I.H. 98
I.H. 231
FLORIDA
PENSACOLA
PANAMA CITY
NAVAL COASTAL SYSTEMS CENTER
I.H. 98
I.H. 19
GULF OF MEXICO
N
ST. PETERSBURG
GRAPHIC SCALE
0 10 20 30 40 50
SCALE IN MILES
OGLETREE ENGINEERING INC.
CORPUS CHRISTI, TEXAS
CHESAPEAKE DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
WASHINGTON, D.C.
LOCATION MAP
FIG. NO.
1


MARINA 311
LANDING CRAFT RAMP 2
LANDING CRAFT RAMP 1
ST. ANDREW'S
PIER 368
SEAWALL 171
PIER 295
SOLOMONS DRIVE
MONORAIL 224
BULLFINCH ROAD
BAYOU
BULKHEAD 146
VERNON DRIVE
PIER 170
SKYLARK ROAD
ALLIGATOR
WEST GATE
PIER 227
PONTOON BARGE
BULKHEAD 358
STATE ROAD NO. 392
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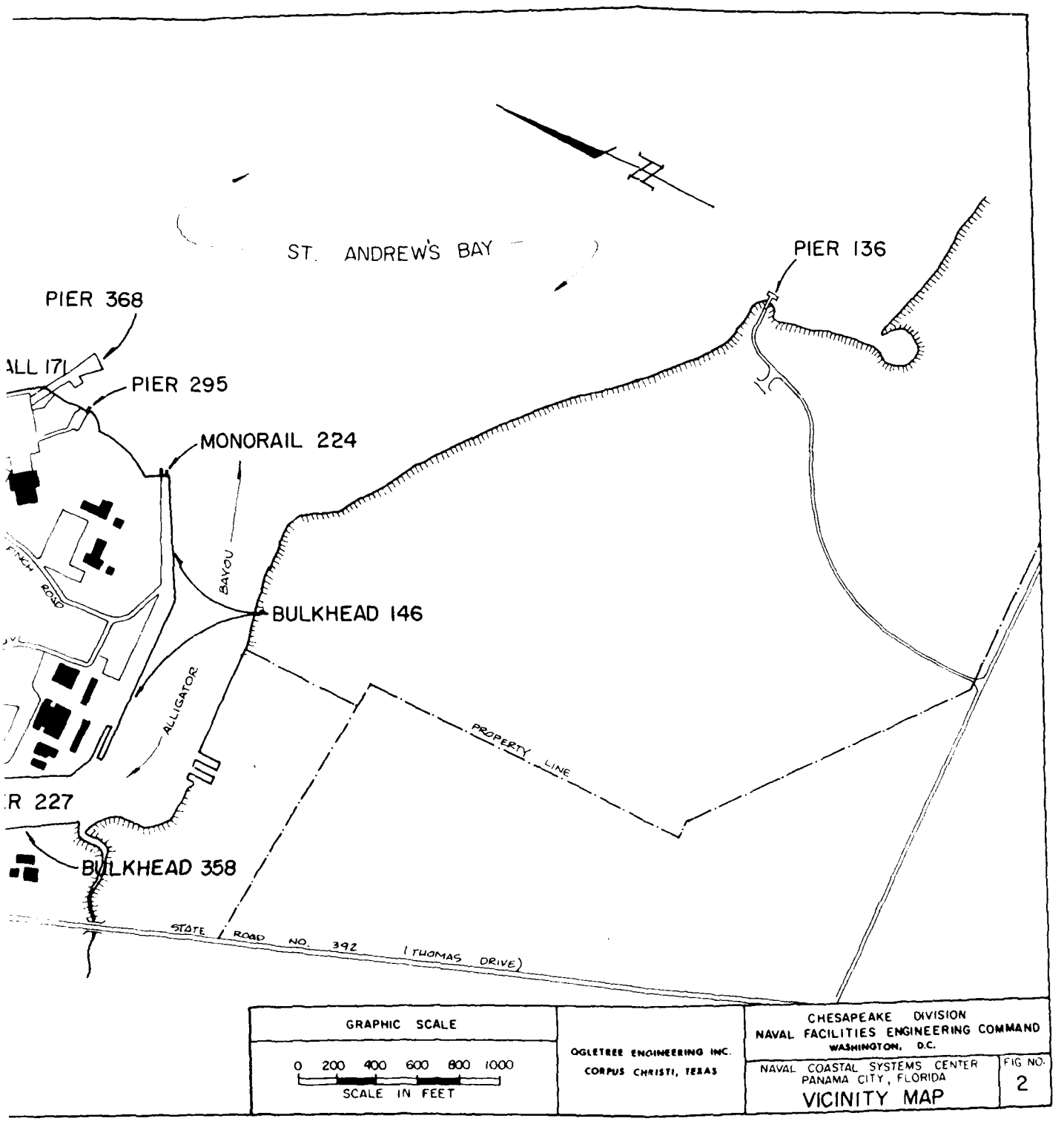
ST. ANDREW'S BAY
PIER 136
PIER 368
ALL 171
PIER 295
MONORAIL 224
BAYOU
FINCH ROAD
BULKHEAD 146
ALLIGATOR
PROPERTY LINE
R 227
BULKHEAD 358
STATE ROAD NO. 392 (THOMAS DRIVE)
GRAPHIC SCALE
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SCALE IN FEET
OGLETREE ENGINEERING INC.
CORPUS CHRISTI, TEXAS
CHESAPEAKE DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
WASHINGTON, D.C.
NAVAL COASTAL SYSTEMS CENTER
PANAMA CITY, FLORIDA
VICINITY MAP
FIG NO.
2

mean temperature range is 76°F to 89°F. The record high temperature is 102°F and the record low is 11°F.

Winter winds, from September through January, are generally from the northeast while the summer winds, from May through August, are out of the southwest. The mean speeds do not vary significantly throughout the year, averaging 7 knots. Peak gusts of 69 knots have been recorded. The chances for hurricane force winds (75 mph or greater) in any given year have been estimated to be about one in twelve.

The mean annual rainfall is 55.2 inches. The maximum precipitation recorded in a 24-hour period was 8.5 inches. Heavy fog is observed 20% to 30% of the year, usually forming late at night and dissipating soon after sunrise.

2.4 TOPOGRAPHY, HYDROLOGY, OCEANOGRAPHIC DATA

The site elevation ranges from 0 to 17 feet above mean sea level (MSL). The maximum height flooded on the station has been eight feet.

Water depths of St. Andrews Bay are shallow, increasing gradually to the dredged Gulf Intracoastal Canal (GIC).

SECTION 3. INSPECTION PROCEDURE

The underwater inspection was performed between June 12 and June 25, 1985. Methods and levels of examination were in accordance with procedures set forth by the Chesapeake Division, Naval Facilities Engineering Command.

3.1 LEVEL OF EXAMINATION

The level of examination was sufficient to provide data to define the overall condition of the structure, to identify areas needing maintenance, and to suggest general cost effective maintenance/repair procedures. Specific levels of examination as defined by the Chesapeake Division, Naval Facilities Engineering Command and applied to this inspection were:

Level I: General Examination: This type of examination was essentially a "swim-by" overview, which did not involve cleaning of any structural elements, and was therefore conducted much more rapidly than the other levels of examination. The Level I examination should detect obvious major damage or deterioration due to overstress, severe corrosion, or extensive biological growth and attack. The underwater inspector relied primarily on visual and/or tactile observations (depending on water clarity) to make condition assessments. Visual documentation (sketches and/or photographs) was included to support the findings.

A Level I examination was performed in the underwater portion of all structural piles. A significant quantity of the examination effort was to verify "as-built" plans.

Level II: Detailed Examination: This type of examination was directed toward detecting and describing damaged or deteriorated areas which were hidden by surface biofouling and toward obtaining limited measurements in deteriorated areas. Level II examinations therefore required cleaning the structural elements. Since cleaning is extremely time consuming, it was restricted to areas that were specified as most likely to reveal representative general conditions and areas identified during the Level I inspection that warranted increased attention.

A Level II examination was specified for approximately 20% of the piles within open type structures (piers and bridges). A Level II bulkhead examination was to be performed an average of every 100 feet for steel sheet piles. Level II examination cleaning procedure was specified as follows:

Concrete Bearing Piles — Band cleaned of biofouling or debris on three sides or faces of each pile to an approximate width of ten (10) inches to expose underlying pile surface for inspection at three elevations; mean low water (MLW), mudline (ML), and mid-depth between MLW and ML.

Wood Bearing Piles — Band cleaned around circumference of the pile to a width of ten (10) inches to expose underlying pile at three elevations; mean low water (MLW), mudline (ML), and mid-depth between MLW and ML. Level II examination for wood piles included measuring minimum pile diameters.

Steel Sheet Piles — Six (6) inch square area of bulkhead cleaned on flange and on web of sheet pile at three areas which include MLW, ML, and mid-depth between MLW and ML.

If an irregular shape or area of apparent distress was detected during the Level I examination, the area was cleaned for more careful examination.

Level III: Highly Detailed Examination: This type of examination involved measuring and/or sampling the structural elements. The purpose of this type of examination is to quantify damage, loss of cross sectional area, and material condition. Measurements should generally quantify the nature and extent of deterioration.

A Level III examination was performed on every steel pile and steel sheet pile bulkhead cleaned during Level II examination. Metal thickness measurements were taken at each location cleaned.

Level III examination of wood piles included taking wood cores at 3 to 5 percent of the structural timber piles. Core samples were taken to the center of each pile at three elevations: mean low water (MLW), mudline (ML), and mid-depth between MLW and ML. Holes were plugged with treated dowels.

The pattern of the inspection and the locations of various levels of examination were determined during the course of the field work, based on the conditions encountered at the structure. More time and detail was spent at areas or locations where deterioration was most likely to be found.

The levels of examination and procedures were flexible to permit modification for particular conditions encountered on the site and to provide for specific needs of each facility.

3.2 INSPECTION PROCEDURE

The inspection was performed by a three man team consisting of an engineer/diver, a technician/diver, and a tender/recorder who was an Engineer-In-Training (EIT).

The inspection procedure varied depending on the requirements of the particular facility. At timber facilities, where considerable time was required for recovering Level III core samples, the technician/diver and EIT performed core extractions while the engineer/diver performed Level I and II examinations, recording information on an underwater slate. At other times, divers would inspect alternate bents, or sections of bulkhead, relaying information to the tender/recorder.

The inspection process included verification of pile counts, physical measurements, and sketches of existing construction where drawings or descriptions were unavailable or varied from information provided. A camera was continually available and utilized for documentation of conditions encountered during the inspection.

3.3 EQUIPMENT

SCUBA equipment was utilized to maximize mobility. An underwater light was occasionally used to improve underwater visibility. Hand held tools (hammer, hatchet, scraper, etc.) were used for removing marine growth and scale and for hammer sounding the structural elements. Depth soundings and other linear measurements were taken with a fiberglass tape. Steel thickness measurements were taken with a KrautKramer DM-2 Ultrasonic Thickness Gauge. This instrument was calibrated daily.

Underwater photographs were taken with a Nikonos III underwater camera, usually with a 15mm lens and a strobe. "Close-up" photos were taken using a 35mm lens with an extension tube and framer. At the site, water clarity was adequate to allow photography without the use of a clear water box. Above water photos were taken with a Nikon F2 camera using a 35mm lens.

Core samples were taken using a pneumatic drill with a dowel cutter, powered by a portable compressor. All core holes were tightly plugged with treated wood dowels.

4.0 FACILITIES INSPECTED

This section contains a discussion of each facility inspected during this project. The discussions are presented in four parts:

A. Description of the type construction and function of the facility.

B. Conditions observed and noted during the inspection.

C. Assessment of the structural condition of the facility.

D. Recommendations for use, maintenance, and operation of the facility in light of the structural assessment.

Drawings and photographs are included within the discussions of each facility to locate and illustrate conditions encountered in the inspections.

The inspection effort and comments are directed toward underwater portions of the structures. General comments referring to conditions and structural capacities do not reflect elements such as deck planking or bulkhead tie backs which could restrict service loads significantly below those of the inspected elements.

4.1 AMMO PIER 136

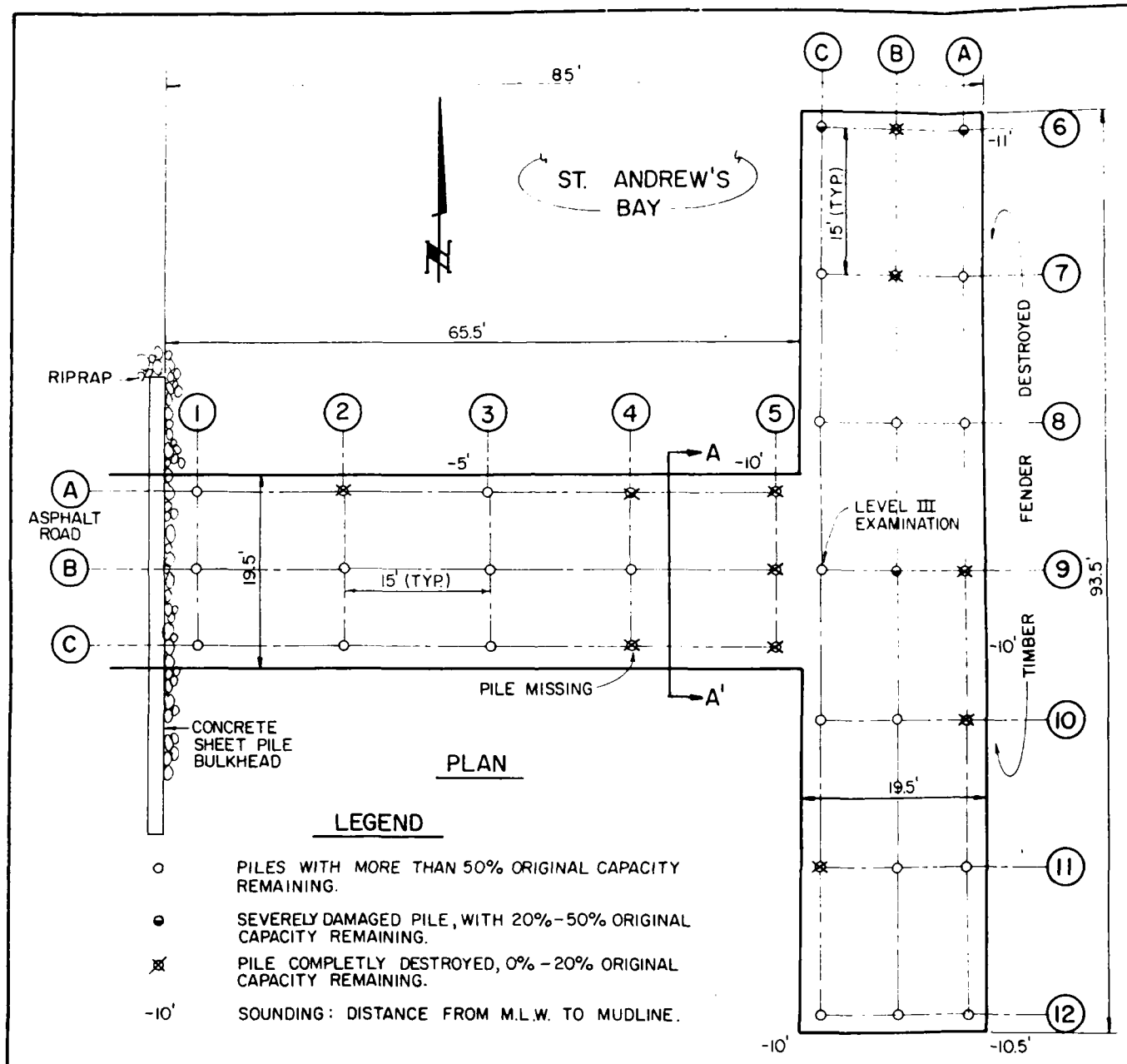
4.1.1 Description

Pier 136 is a timber pile foundation structure with a concrete deck. The pile foundation consists of 12 bents of three timber piles per bent. The pier is "T" shaped, with a concrete deck width of 19.5 feet and a total length of 85 feet. Concrete encasements have been installed on all piles, circa 1968, to structurally restore damage which had resulted from marine borer infestation (See Figure 3). At the time of this inspection, pier use was restricted due to suspected structural weakness.

4.1.2 Observed Inspection Conditions

Concrete encased timber piles that supported the dock were extensively damaged. Below the waterline, the concrete encasements were typically eroded and ineffective, leaving the reinforcing steel and timber largely exposed to seawater. Much of the remaining concrete is soft, poor quality material. Exposed timber was infested with marine borers (Limnoria) which had completely destroyed 11 piles (See Photo 1). Three additional piles had been reduced to the extent that their bearing capacity was minimal. Specific conditions of piles are as follows:

PILE ID	CONDITION
1A	Encased into riprap, some encasement erosion at bottom.
1B	Encased into riprap, some encasement erosion at bottom.
1C	Encased into riprap, some encasement erosion at bottom.



PLAN

LEGEND

o	PILES WITH MORE THAN 50% ORIGINAL CAPACITY REMAINING.
⊖	SEVERELY DAMAGED PILE, WITH 20%–50% ORIGINAL CAPACITY REMAINING.
⊗	PILE COMPLETLY DESTROYED, 0% – 20% ORIGINAL CAPACITY REMAINING.
-10'	SOUNDING: DISTANCE FROM M.L.W. TO MUDLINE.

NOTE: LEVEL II EXAMINATION PERFORMED ON ALL PILES.

GRAPHIC SC

0 5 10

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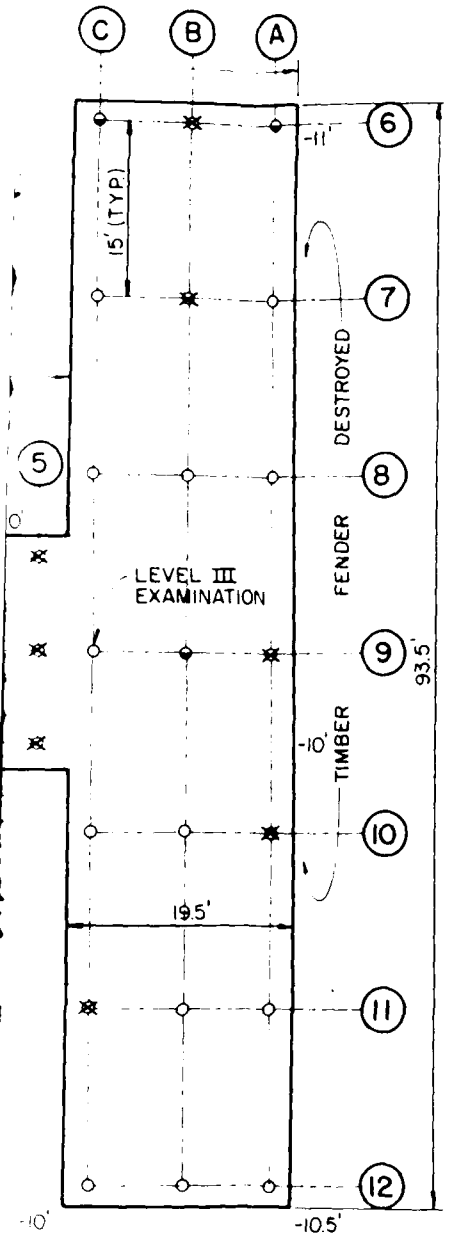

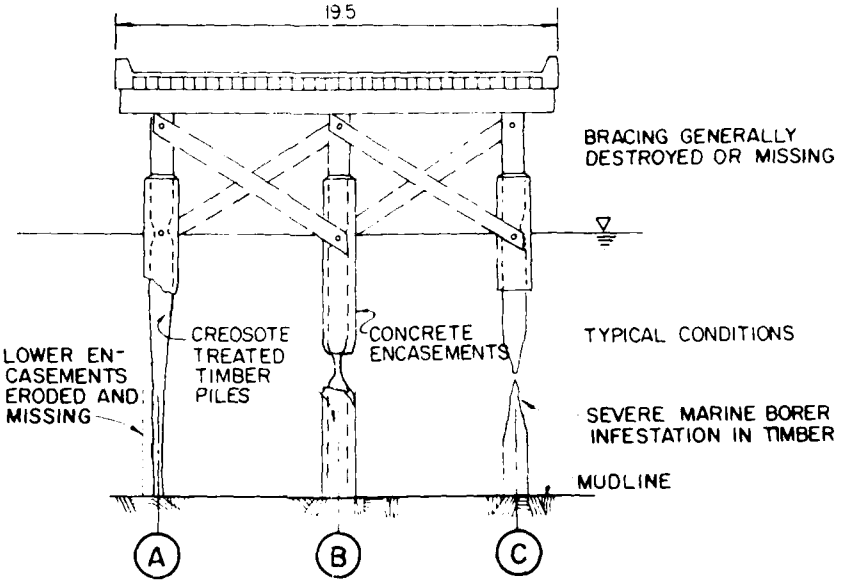

SECTION A-A'

GRAPHIC SCALE			
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		NAVAL COASTAL SYSTEMS CENTER PANAMA CITY, FLORIDA PIER 136	FIG NO 3

PHOTO 1

Pier 136, showing close-up (3 x actual size) of marine borers (Limnoria) in infested timber.

PHOTO 2

Pier 136, Pile 6B, showing remnants of reinforcing steel. Concrete encasement is completely eroded and original timber has been destroyed by marine borers.

PILE ID	CONDITION
2A	Completely destroyed at bottom, encasement and timber gone.
2B	Encasement eroded, timber exposed and 40%± destroyed.
2C	Encasement eroded, timber exposed and 40%± destroyed.
3A	Encasement eroded, timber exposed and 30%± destroyed.
3B	Encasement eroded, timber exposed and 30%± destroyed.
3C	Encasement eroded, timber exposed and 30%± destroyed.
4A	Encasement eroded, timber exposed and 80%± destroyed.
4B	Encasement eroded, timber exposed and 40%± destroyed.
4C	Completely destroyed, missing.
5A	Encasements eroded and missing, timber 75% - 80% destroyed.
5B	Encasements eroded and missing, timber 75% - 80% destroyed.
5C	Encasements eroded and missing, timber 75% - 80% destroyed.

PILE ID	CONDITION
6A	Encasement eroded and missing, timber 60% - 70% destroyed.
6B	Completely destroyed, encasement missing below -3' to ML (See Photo 2).
6C	Encasement missing below -3', timber 75% destroyed.
7A	Encasement largely intact, eroded at ML. Timber exposed, not severely reduced.
7B	Encasement missing below -3'. Timber 80% destroyed.
7C	Bottom 4' encasement eroded. Timber 30%± destroyed.
8A	Encasement missing below -4'. Timber 30%± destroyed.
8B	Bottom 4' encasement eroded. Timber 30%± destroyed.
8C	Bottom 4' encasement eroded. Timber 30%± destroyed.
9A	Completely destroyed. Encasement missing.
9B	Encasement missing below -3'. Timber 70%± destroyed.
9C	Encasement eroded below -3'. Timber 30%± destroyed.

PILE ID	CONDITION
10A	Completely destroyed. Encasement missing below -3'.
10B	Encasement missing below -3'. Timber 30%± destroyed.
10C	Encasement irregular below -3'. Timber 40%± destroyed (See Photo 3).
11A	Encasement largely intact, holes eroded to timber.
11B	Encasement eroded lower -3'. Timber exposed.
11C	Completely destroyed at mudline.
12A	Encasement eroded below -3'. Timber reduced but inaccessible to quantify.
12B	Encasement largely intact, eroded at ML (See Photo 4).
12C	Encasement eroded below -3'. Timber 30%± destroyed.

The diagonal bracing members were virtually all ineffective; either completely missing or destroyed at the lower connections.

Above the waterline, the encasements, timber substructure, and concrete deck appear to be in good condition.

4.1.3 Structural Condition Assessment

The structural integrity of Pier 136 has bee. severely impaired, primarily by marine borer infestation and secondarily by degradation of an ineffective encasement installation. One third

PHOTO 3

Pier 136, Pile 10C, showing eroded encasement with exposed reinforcing steel and reduced original timber pile.

PHOTO 4

Pier 136, Pile 11C, showing concrete encasement eroded at mudline.

of the piles have lost from 75% to 100% of their bearing capacity. Marine borer attack is active and will continue to further weaken the timber piles.

Vehicle traffic is presently restricted from Pier 136. The structure is occasionally utilized to conduct experiments requiring only pedestrian access. Restriction of vehicles is definitely appropriate. The pier is structurally inadequate to support vehicle traffic. The design dead load of the pier's superstructure is a maximum of approximately 16 kips per pile (See Appendix, Structural Calculations). Many piles are supporting increased dead loads due to the loss of bearing capacity of adjacent piles. It is unlikely that structural failure would occur by addition of minor pedestrian live loads. However, it is likely that failure could occur at virtually any time as a result of storm generated waves and wind. A possible scenario would include failure of a particularly vulnerable, weakened section of pier, such as bent 6, initiating a sequential failure of adjacent bents.

4.1.4 Recommendations

It is recommended that strict load restrictions be continued at Pier 136. A semi-permanent barricade should be installed to physically restrict load access to the structure, which appears to be substantial when viewed from above the waterline.

Recommended maintenance to the pier is contingent upon the desired use of the structure.

If a structure of similar capacity of the original pier is desired, an extensive structural rehabilitation or rebuilding of the pier is necessary.

Estimated replacement cost for the existing pier is $130,000. Additional cost for demolition and removal of the existing pier would be $20,000 (See Appendix, Cost Estimate Calculations).

Structural restoration of the existing piling is possible, if performed promptly, before further deterioration occurs. Restoration would require:

A. Remove marine growth and remaining concrete encasement material.

B. Excavate around original timber piles sufficiently to expose two feet of undamaged timber.

C. Install reinforcing steel cage and rigid form or install reinforcing steel cage and flexible form.

D. Place concrete.

This restoration should be performed with extreme caution. Encasement removal and construction operations could cause further damage to the piles. If a repair project is not performed within a year, the piles should be re-inspected to determine if continued borer attack has rendered the pier too hazardous to withstand construction activity.

If a restoration project is implemented, the work should be designed, installed and inspected by personnel familiar with the type of procedure used to assure that an effective, durable repair is achieved.

Estimated cost to restore the piles of Pier 136 to their original capacity is $100,800 (See Appendix, Cost Estimate Calculations).

An alternative to repair is the replacement of the existing pier with a structure having less capacity than the original structure. A timber pier with a comparable work area, capable of supporting a loaded pickup truck, could be constructed for an estimated cost of $110,000.

The cost could be reduced to an estimated $87,000 if the pier is limited to pedestrian and minor equipment loads.

4.2 BULKHEAD 146

4.2.1 Description

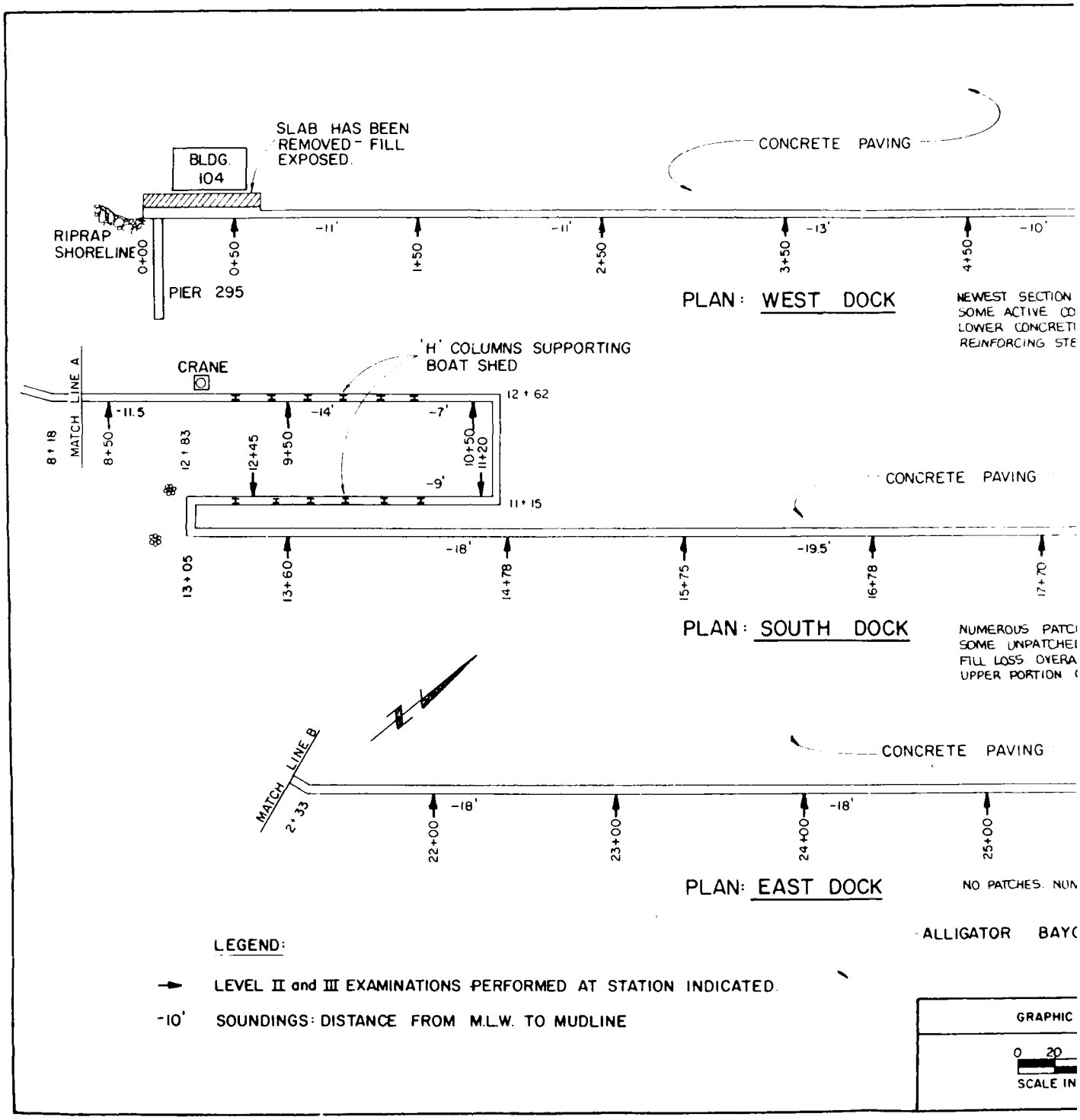
Bulkhead 146 forms the land to water interface along Alligator Bayou at the northern tract of the NCSC. The bulkhead is constructed of steel sheet piles with a concrete cap extending below the waterline. Total length of the bulkhead is 2,892 feet, consisting of the West Dock, South Dock, and East Dock, 818 feet, 1,315 feet and 759 feet in length, respectively (See Figures 4 and 5). The bulkhead provides mooring and service facilities for various vessels operating out of NCSC.

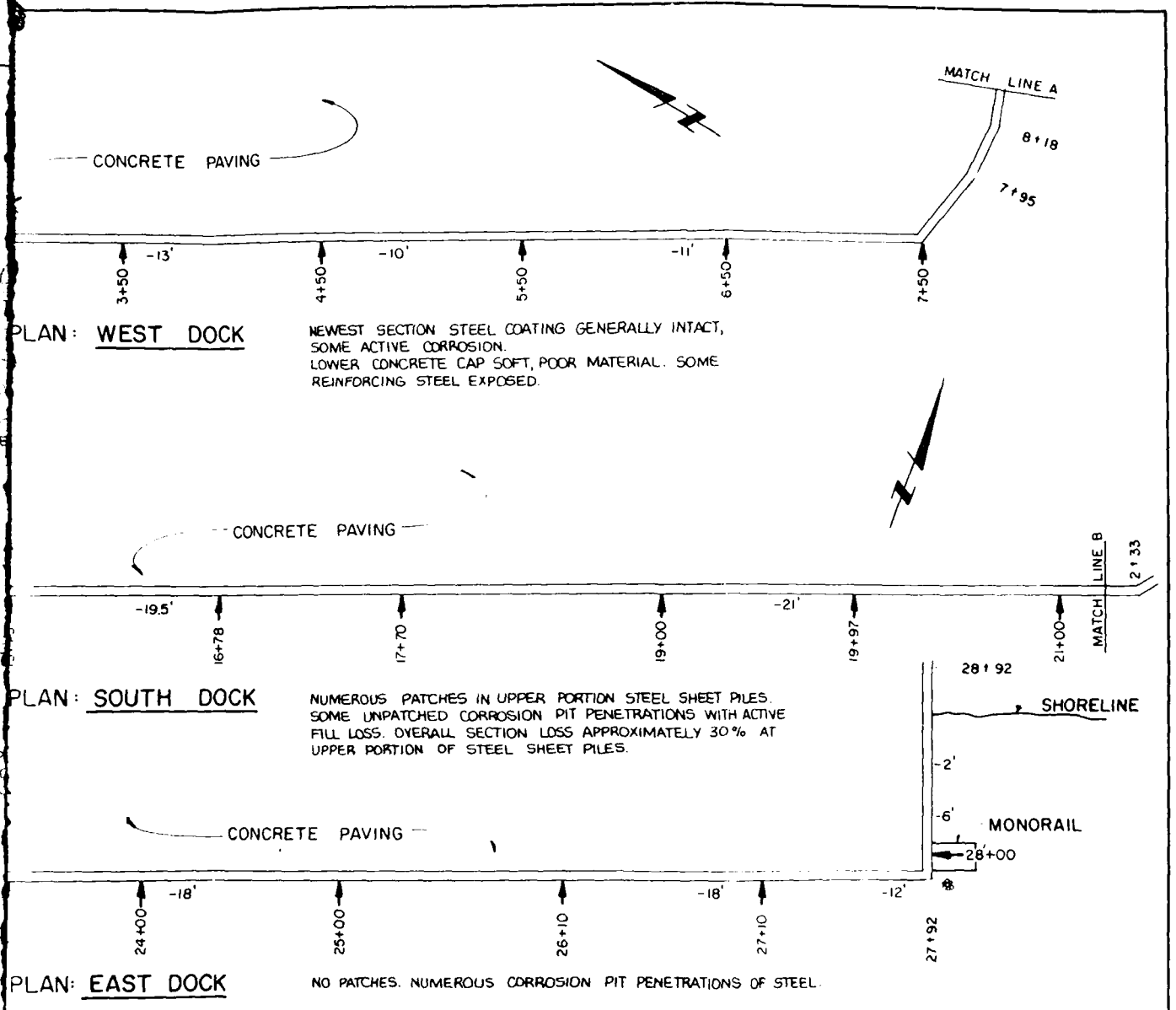
4.2.2. Observed Inspection Conditions

West Dock, Station 0+00 to 8+18: This portion of Bulkhead 146 was rebuilt in 1982-83. The steel sheet piles were found to be in very good condition, with all interlocks tight and intact. Protective coating was generally intact although beginning of pits were found in random isolated locations. All measurements indicated no general loss of steel thickness.

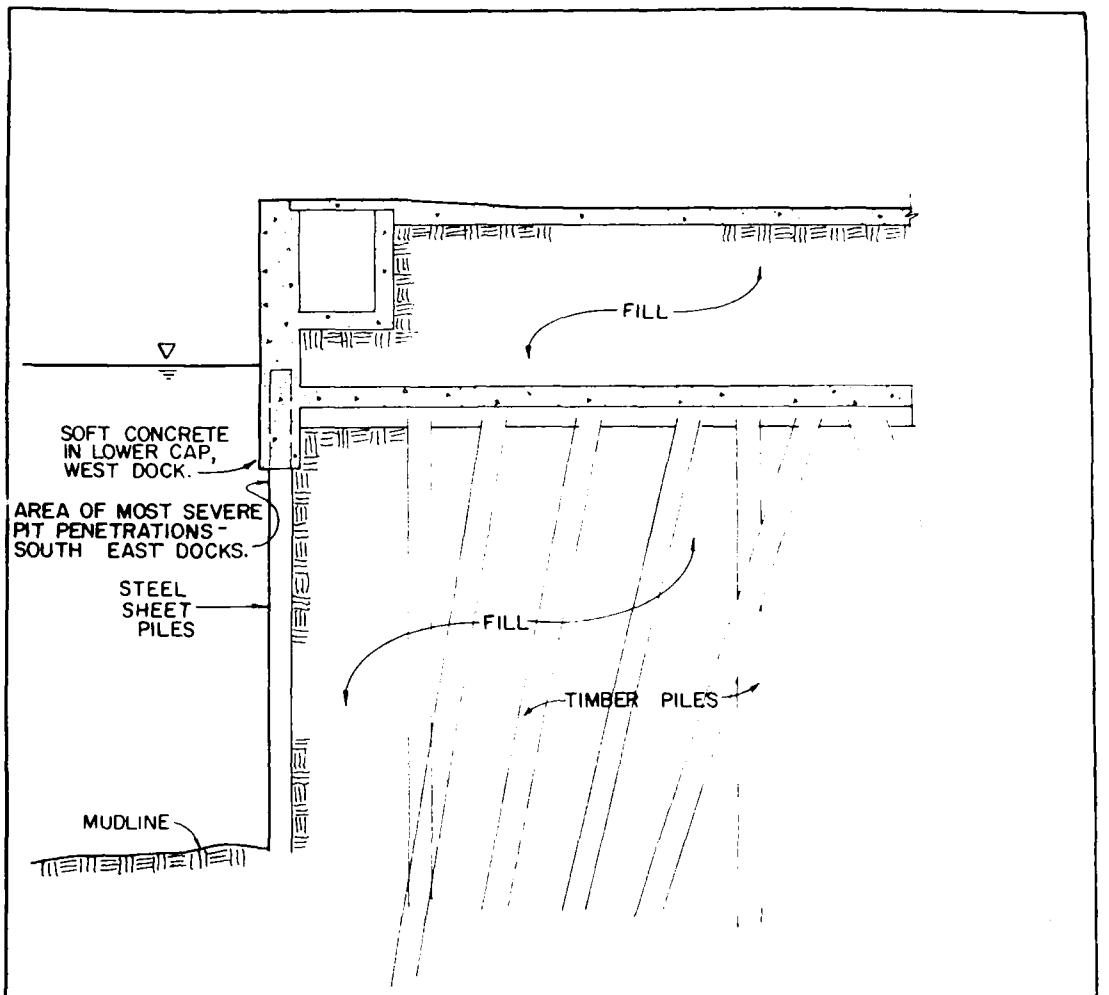
The lower portion of the concrete cap consisted of very soft, poor quality concrete. The material crumbled and broke with very little impact, and reinforcing steel was already exposed at several locations (See Photo 5). This condition gradually improved upward from the bottom of the cap, and concrete near and above the waterline appeared to be satisfactory. It was observed that even the softest areas of concrete were covered with marine growth, which indicates that the cap has stabilized and is not continually sloughing away.

South Dock, Station 8+18 to 21+33: This section of dock represents older, but similar construction. The steel sheet piles have been actively corroding, with most advanced section losses occurring at the upper portion of the steel sections near


SLAB HAS BEEN REMOVED - FILL EXPOSED.
BLDG. 104
CONCRETE PAVING
RIPRAP SHORELINE
PIER 295
0+00
0+50
1+50
2+50
3+50
4+50
-11'
-11'
-13'
-10'
PLAN: WEST DOCK
NEWEST SECTION
SOME ACTIVE CO
LOWER CONCRETI
REINFORCING STE
'H' COLUMNS SUPPORTING BOAT SHED
CRANE
MATCH LINE A
8+18
8+50
12+83
12+45
9+50
10+50
11+20
12+62
11+15
-11.5
-14'
-7'
-9'
CONCRETE PAVING
13+05
13+60
14+78
15+75
16+78
17+70
-18'
-19.5'
PLAN: SOUTH DOCK
NUMEROUS PATCI
SOME UNPATCHEI
FILL LOSS OVERA
UPPER PORTION
MATCH LINE B
2+33
CONCRETE PAVING
22+00
23+00
24+00
25+00
-18'
-18'
PLAN: EAST DOCK
NO PATCHES. NUM
ALLIGATOR BAY
LEGEND:
LEVEL II and III EXAMINATIONS PERFORMED AT STATION INDICATED.
-10' SOUNDINGS: DISTANCE FROM M.L.W. TO MUDLINE
GRAPHIC
0 20
SCALE IN



GRAPHIC SCALE		CHESAPEAKE DIVISION NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON, D.C.	
0 20 40 60 SCALE IN FEET	OGLETREE ENGINEERING INC. CORPUS CHRISTI, TEXAS	NAVAL COASTAL SYSTEMS CENTER PANAMA CITY, FLORIDA BULKHEAD 146	FIG NO 4



TYPICAL SECTION

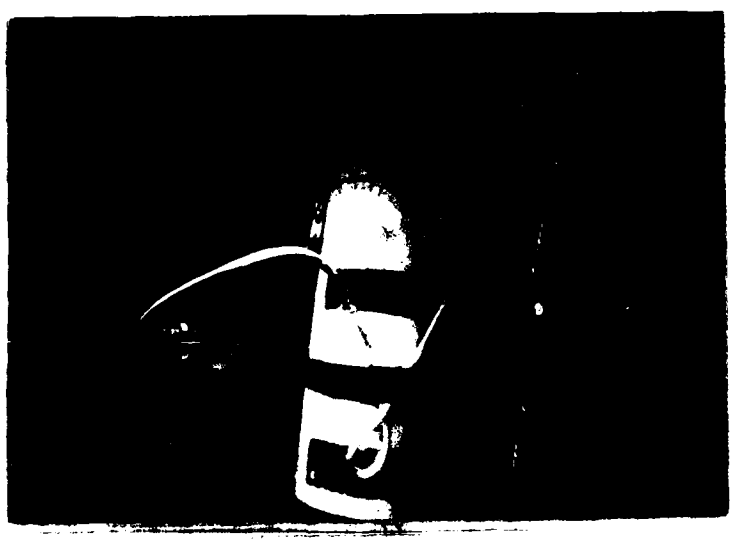
GRAPHIC SCALE		
0 1 3 6 12 SCALE IN FEET	OGLETREE ENGINEERING INC. CORPUS CHRISTI, TEXAS	CHESAPEAKE DIVISION NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON, D.C. NAVAL COASTAL SYSTEMS CENTER PANAMA CITY, FLORIDA BULKHEAD 146 — FIG. NO. 5

PHOTO 5

Bulkhead 146, West Dock, Station 0+25, showing exposed reinforcing steel and soft concrete at lower cap.

PHOTO 6

Bulkhead 146, South Dock, Station 13+60, showing ultrasonic thickness measurement of steel sheet pile near the concrete cap. Thickness reading is .290". Original thickness was .375".



the concrete cap. Typical thickness measurements in this zone indicated section losses of less than 30% (See Photo 6). An extensive "hole patching" program had occurred in recent years. Many of these patches were located and found to be intact and functioning as intended (See Photo 7). A moderate number of unpatched holes were found. Most holes were found in the upper portions of the steel sheet piles near the cap, although penetrations with active fill loss were found between 10 and 15 feet below the waterline (See Photo 8). Thickness measurements in this zone did not indicate general section losses. Penetrations were a result of "pitting".

> Pitting, an extremely localized form of attack resulting in holes in the metal, is one of the most destructive and insidious forms of corrosion. It can cause severe structural damage with only a small percentage of overall section loss. Pits are often difficult to detect because of the varying depths and numbers that may occur under similar conditions.[1]

In many areas, plates of corrosion scale with marine growth on the outside were easily removed, exposing the metal surface. Beneath the loose scale, the steel was coated by corrosion products in the form of a tight black scale, or less frequently, a loose powder. The concrete cap was generally sound and intact, but irregular at the steel interface.

East Dock, Station 21+33 to 28+92: This section of bulkhead was a continuation of construction of the South Dock and was apparently the same age. Conditions were found to be very similar except that no attempts to patch corrosion holes had been made. Consequently numerous holes through the steel allow water transfer and fill loss through the bulkhead (See Photos 9 and 10). The majority of those holes occurred at the interface

1. Joseph F. Bosich, Corrosion Prevention for Practicing Engineers, 1970, Barnes and Noble, pp. 40-41.

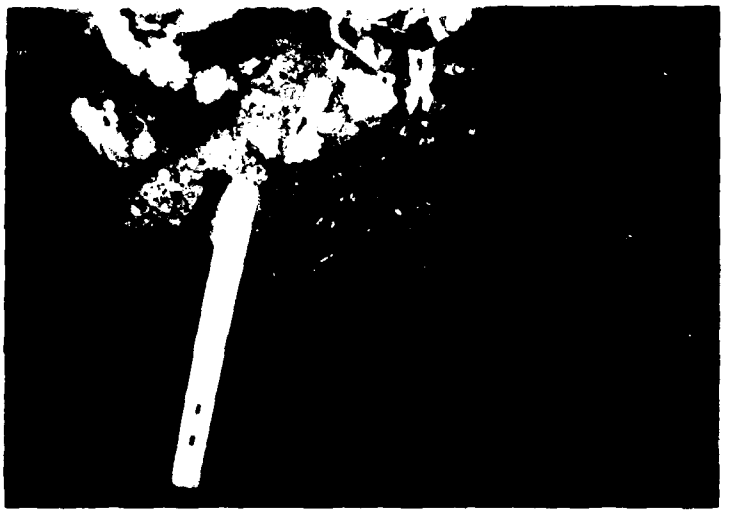


PHOTO 7

Bulkhead 146, South Dock, near Station 14+40, showing welded patch.

PHOTO 8

Bulkhead 146, South Dock, near Station 17+92, showing "pit" hole 12' below the waterline with active fill loss.

PHOTO 9

Bulkhead 146, East dock, Station 27+18, showing pit hole in steel.

PHOTO 10

Bulkhead 146, East Dock, Station 27+18, at mudline (19' below waterline) showing deposit of fill material lost through hole in Photo 9.

between the steel sheet pile and the concrete cap, and were between ½" and 2" in diameter. The holes are difficult to detect due to their small size and partial obstruction by marine growth (See Photo 11). Some of the holes appear to be exposed "handling holes" in the original sheet piles, but most are a result of corrosion pitting. Typically, substantial metal thickness was measured immediately adjacent to a hole.

An impressed current cathodic protection system was in place along the entire length of Bulkhead 146. The system reportedly was new, and its effectiveness has not been fully determined. Corrosion scale on the South and East Docks probably pre-dates the cathodic protection system. It was observed that cleaned steel surfaces accumulated rust overnight, which indicates that corrosion is active, but not necessarily that the cathodic protection is ineffective (See Photo 12).

4.2.3 Structural Condition Assessment

West Dock: The West Dock Bulkhead is relatively new and is structurally sound.

The soft concrete in the lower portion of the cap presents an indirect problem. The primary purpose for extending the concrete below the waterline is to provide protection for the steel in the severely corrosive splash zone environment. Loss of the protective cover could result in accelerated deterioration of the steel sheet piles. Although much of the lower cap concrete is very poor quality, it appears to provide protective cover of the steel, for the most part. The existing fender system is substantial and should prevent damage to the soft concrete.

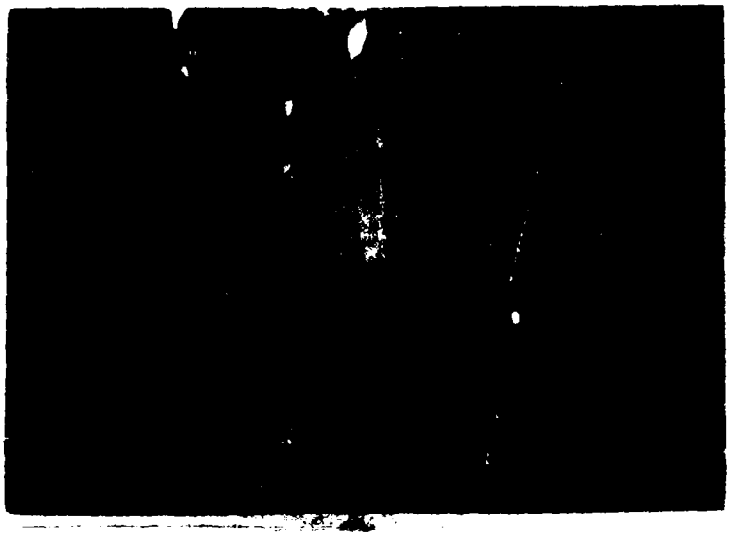
South Dock: Structurally, the South Dock is in good condition. The patches appear to be well done and effective. Some unpatched holes were found.

PHOTO 11

Bulkhead 146, East Dock, near Station 28+00, showing hole through steel at concrete cap.

PHOTO 12

Bulkhead 146, showing typical cleaned Level III site approximately 48 hours after cleaning. Note accumulation of rust indicating active corrosion.



East Dock: The structural condition of this section of bulkhead is similar to the South Dock. Holes through the steel have not been patched. It appears likely that fill loss behind the wall is more extensive as a result of the unpatched holes.

According to the design drawings, Bulkhead 146 is not dependent on the backfill for support, but consists of a relieving platform supported by timber piles. Therefore, if substantial steel sheet pile section remains, fill loss is not a direct structural threat. However, water passage and fill loss through the wall presents two potential threats. The main concern is that the timber piles supporting the structure will be exposed to water circulation and subsequent attack by marine borers, prevalent in the vicinity. Another cause for concern is that both sides of the steel are exposed to oxygenated seawater, permitting corrosion deterioration from both sides.

4.2.4. Recommendations:

It is recommended that a program be initiated to locate and patch holes in the steel. The procedure should include the following steps:

A. Remove all marine growth from the upper two feet of exposed sheet piles and the lower edge of the concrete cap. This work can be performed with a waterblaster, taking care that the pressure is set so that the concrete is not unnecessarily damaged. It is expected that cleaning will reveal holes that are generally obscured by marine growth and/or scale.

B. Holes can then be patched with various techniques depending on their size and location. Small holes can be filled by direct welding rod application. Larger holes can be patched with plates welded to sheet pile surface. When holes extend into the concrete cap, an epoxy grout should be effective as a plug and cover at the steel to concrete interface.

A similar project performed "in-house" on the South Dock would provide the most accurate cost estimate. Most time and effort will be required for cleaning and locating the holes.

Estimated cost to perform the work is $52,500 (See Appendix, Cost Estimate Calculations).

The effectiveness of the cathodic protection system should be monitored and evaluated. Corrosion appears to be active, based on the accumulation of overnight rust on cleaned steel surfaces.

The cathodic protection system should be tested and inspected at least twice a year. If it is determined that the system is operating effectively and consistently, the inspection interval may be extended. The steel sheet piles and concrete cap should be reinspected every two years.

4.3 BULKHEAD 358

4.3.1 Description

Bulkhead 358 forms the land and water interface at the Dive School, on the south side of Alligator Bayou. The bulkhead is 818 feet long, constructed of steel sheet piles with a concrete cap. The structure provides mooring and service facilities for vessels operating out of the dive school, and also provides easy access to the water for diver training (See Figure 6).

4.3.2 Observed Inspection Conditions

All accessible components of the bulkhead were in excellent condition. The coating on the steel sheet piles was generally intact and all steel measurements indicated no reduction of original metal thickness. Beginnings of pits were detectable in the form of rust spots at random locations throughout the wall. When these spots were cleaned, a breach in the protective coating and the beginnings of pits in the metal were revealed (See Photos 13 and 14). There was no cathodic protection observed at this bulkhead.

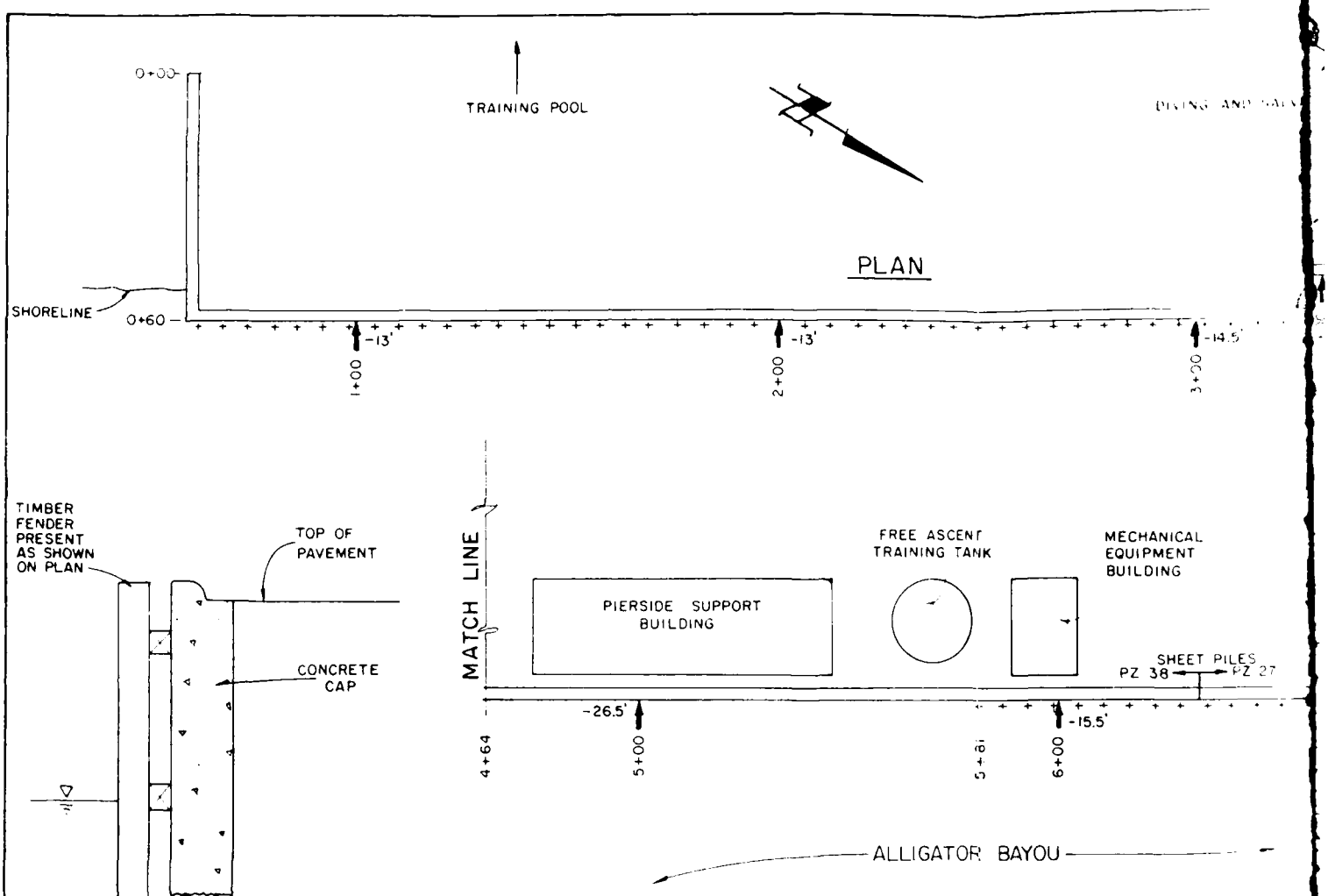
All concrete in the cap appeared to be sound, high quality material.

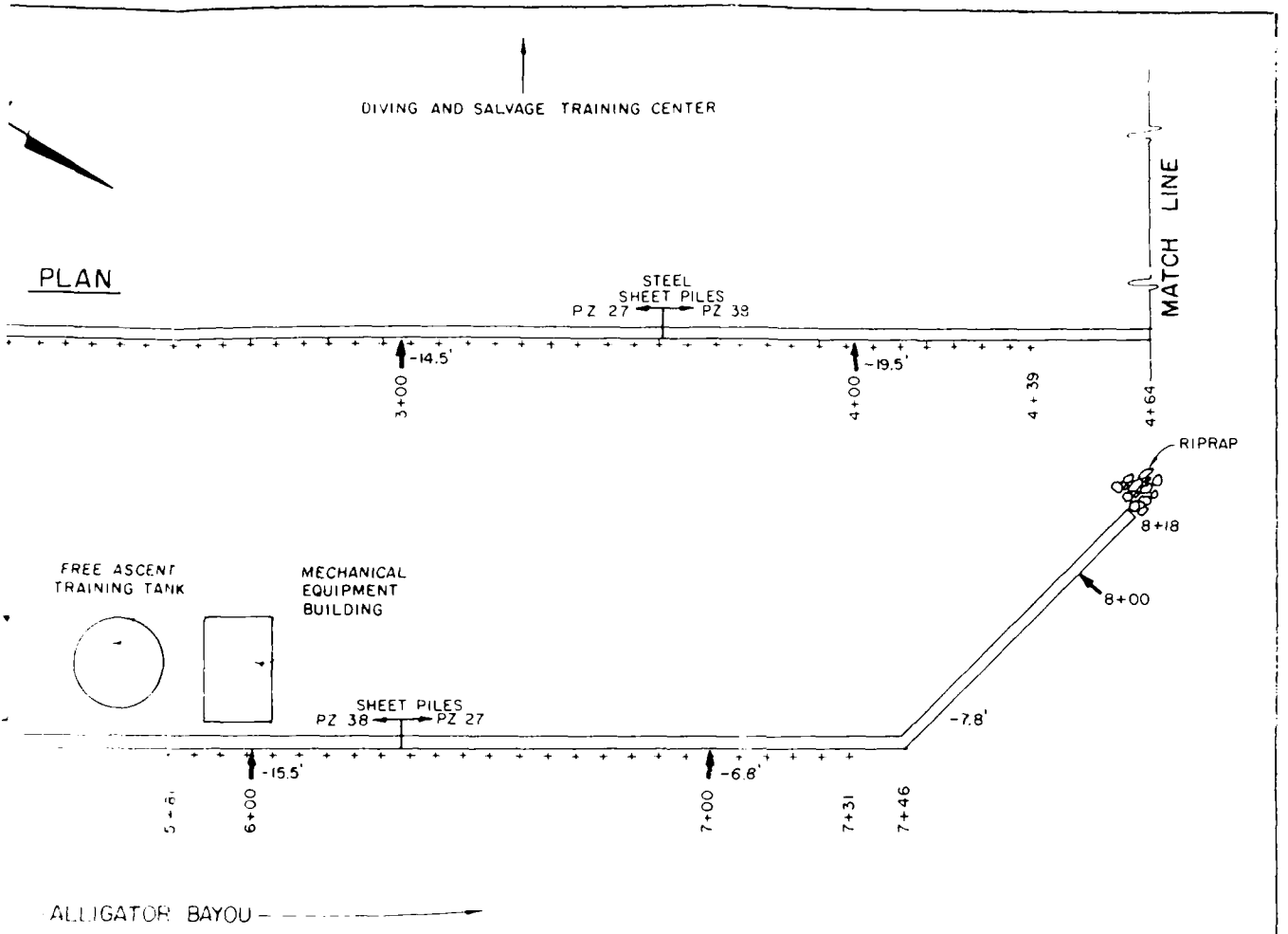
4.3.3. Structural Condition Assessment

Bulkhead 358 is structurally sound, in excellent condition, and able to serve it's designed function.

4.3.4 Recommendations

Installation of a cathodic protection system along Bulkhead 358 should be considered. Corrosion attack is in very early stages and has not affected the structural integrity. However, areas of


0+00
TRAINING POOL
PLAN
SHORELINE
0+60
-13'
-13'
-14.5'
1+00
2+00
3+00
MATCH LINE
PIERSIDE SUPPORT BUILDING
FREE ASCENT TRAINING TANK
MECHANICAL EQUIPMENT BUILDING
SHEET PILES
PZ 38
PZ 27
-26.5'
-15.5'
4+64
5+00
5+81
6+00
ALLIGATOR BAYOU
TIMBER FENDER PRESENT AS SHOWN ON PLAN
TOP OF PAVEMENT
CONCRETE CAP
STEEL SHEET PILE
MUDLINE
TYPICAL SECTION
SCALE 1"= 4'
NOTE: ALL LEVEL III THICKNESS MEASUREMENTS INDICATE FULL STEEL THICKNESS.
GRAPHIC SCALE
0
20
SCALE IN FEET



LEGEND

⟶	LEVEL II & III EXAMINATIONS PERFORMED AT STATIONS INDICATED.
+ +	FENDER SYSTEM
-10'	SOUNDINGS: DISTANCE FROM M.L.W. TO MUDLINE.

CKNESS
DICATE
NESS.

GRAPHIC SCALE			
0 20 40 SCALE IN FEET	OGLETREE ENGINEERING INC CORPUS CHRISTI, TEXAS	CHESAPEAKE DIVISION NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON, D.C.	
		NAVAL COASTAL SYSTEMS CENTER PANAMA CITY, FLORIDA BULKHEAD 358	FIG NO 6

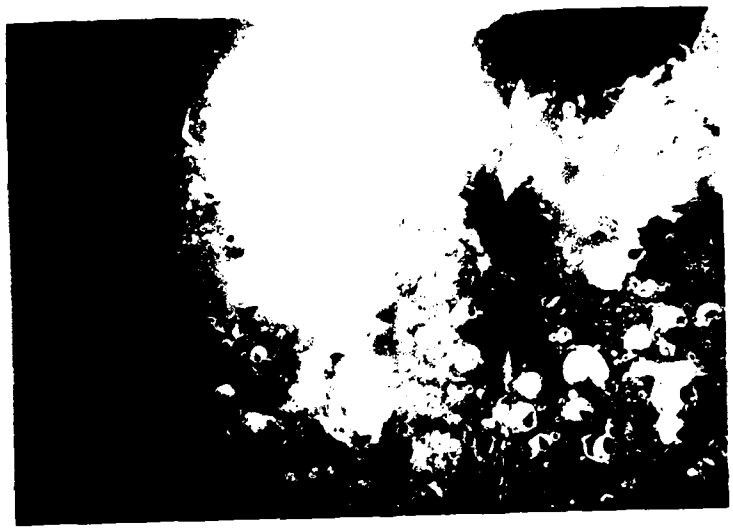


PHOTO 13

Bulkhead 358, near Station 4+00, showing steel sheet pile and appearance of rust spots before cleaning.

PHOTO 14

Bulkhead 358, showing close up (1½ x actual size) of cleaned rust spot in Photo 13. Notice failure of protective coating and beginnings of pit penetrations.

active corrosion are present and can be expected to increase in number and severity. Estimated cost to install an active cathodic protection system is $75,000 (See Appendix, Cost Estimate Calculations).

4.4 MARINA 311

4.4.1 Description

Marina 311 provides berths for pleasure craft. The timber pier is supported by 91 CCA treated piles and 9 mooring piles. Total length of the timber deck is 339 feet (See Figure 7).

4.4.2 Observed Inspection Conditions

All timber piles, deck, and connecting hardware were found to be in excellent condition. No sign of decay or marine borer activity was detected (See Photo 15).

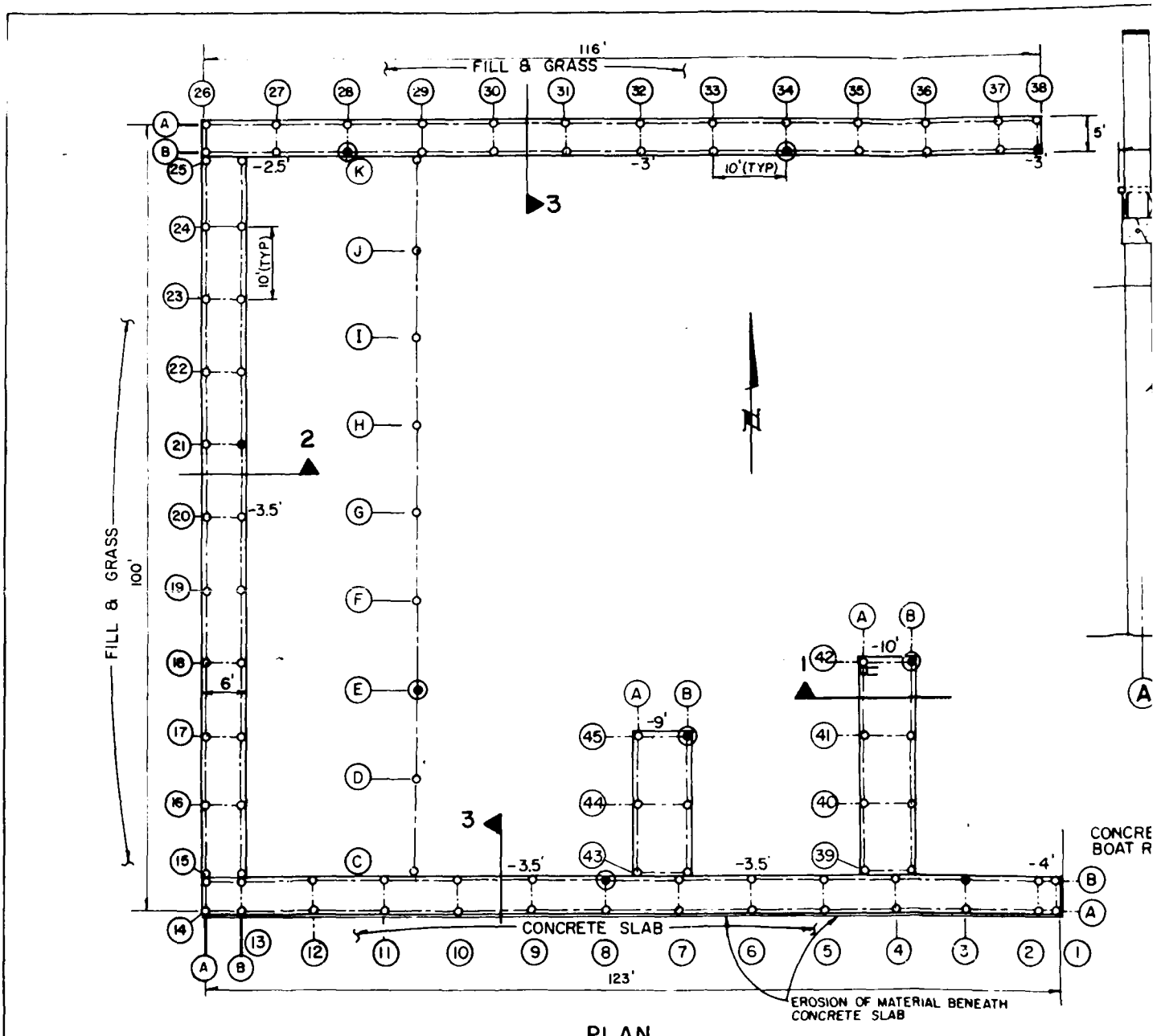
The only anomaly noted was not a part of the dock structure, but is visible from underneath the timber deck. The problem is erosion of material from beneath the concrete slab adjacent to the deck. This erosion results from wave and tide action which occurs immediately below the slab. Some voids were observed to penetrate up to four feet from the edge of the slab (See Photo 16).

4.4.3 Structural Condition Assessment

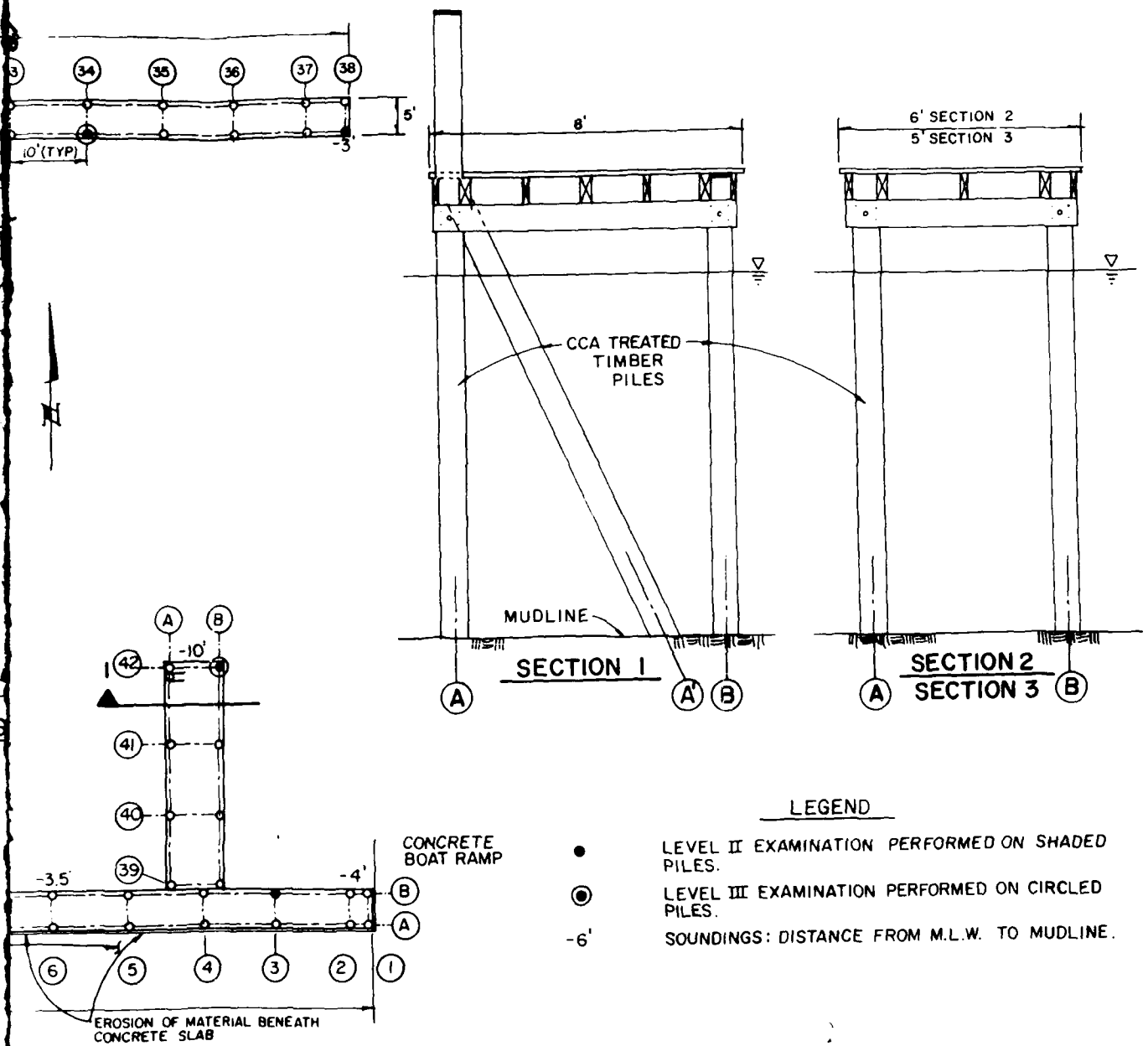
All components of the timber marina pier are in excellent condition.

4.4.4 Recommendations

Shoreline erosion control should be implemented at the marina basin shoreline beneath the concrete slab. The initial recommended procedure is to manually place sacks of pre-mix concrete in the voids and along the tidal zone. The shoreline should be monitored and additional protection added as required periodically to maintain stability. Estimated cost to perform this work is $5,000 (See Appendix, Cost Estimate Calculations). The timber pier should be included in a regularly scheduled inspection program and re-examined in three years.


116'
FILL & GRASS
26
27
28
29
30
31
32
33
34
35
36
37
38
A
B
25
-2.5'
K
-3'
10'(TYP)
-3'
5'
3
24
10'(TYP)
J
23
I
22
H
21
2
-3.5'
G
20
FILL & GRASS
100'
19
F
18
6'
E
17
D
16
3
15
C
-3.5'
43
-3.5'
39
-4'
CONCRE
BOAT R
14
CONCRETE SLAB
13
12
11
10
9
8
7
6
5
4
3
2
1
123'
EROSION OF MATERIAL BENEATH
CONCRETE SLAB
A
B
-10'
42
1
A
B
-9'
45
41
44
40
GRAPHIC
0 5
SCALE IN

PLAN



LEGEND

- ● LEVEL II EXAMINATION PERFORMED ON SHADED PILES.
- ◉ LEVEL III EXAMINATION PERFORMED ON CIRCLED PILES.
- -6' SOUNDINGS: DISTANCE FROM M.L.W. TO MUDLINE.

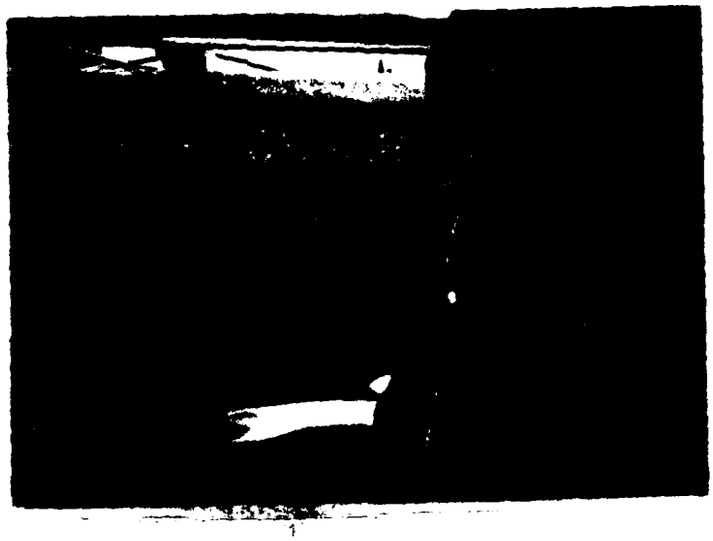
GRAPHIC SCALE 0 5 10 15 SCALE IN FEET	OGLETREE ENGINEERING INC CORPUS CHRISTI, TEXAS	CHESAPEAKE DIVISION NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON, D.C. NAVAL COASTAL SYSTEMS CENTER PANAMA CITY, FLORIDA MARINA 311 FIG NO 7

PHOTO 15

Marina 311, Pile 40A, showing typical condition of timber pile at mudline.

PHOTO 16

Marina 311, near Bent 5, showing void washed out beneath adjacent concrete slab.



4.5 PIER 295

4.5.1. Description

Pier 295 is a pedestrian timber structure supported by 16 CCA treated timber piles. The pier, located on the shoreline of St. Andrews Bay near the helicopter landing pad, is 70 feet long and 5 feet wide (See Figure 8).

4.5.2 Observed Inspection Conditions

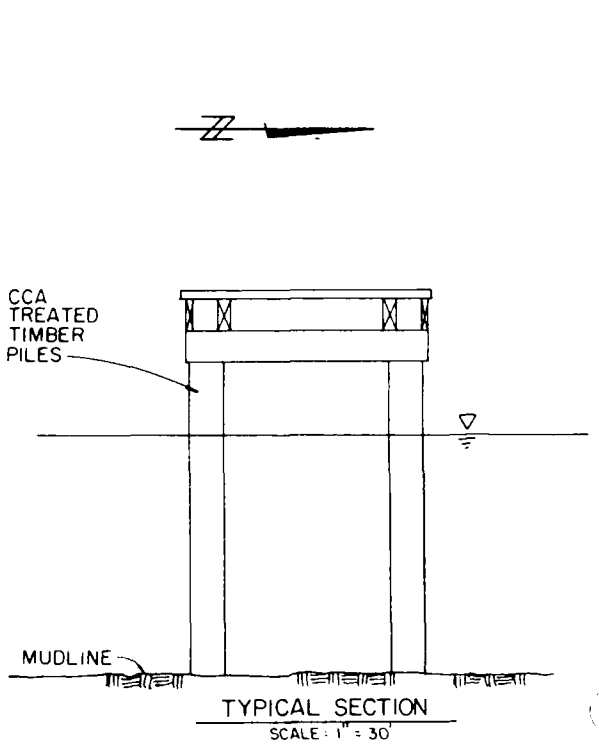
All timber components and connecting hardware are in excellent condition (See Photos 17 and 18). No sign of significant decay or marine borer activity was detected at any structural member. Untreated timbers forming a fender system were decaying.

4.5.3 Structural Condition Assessment

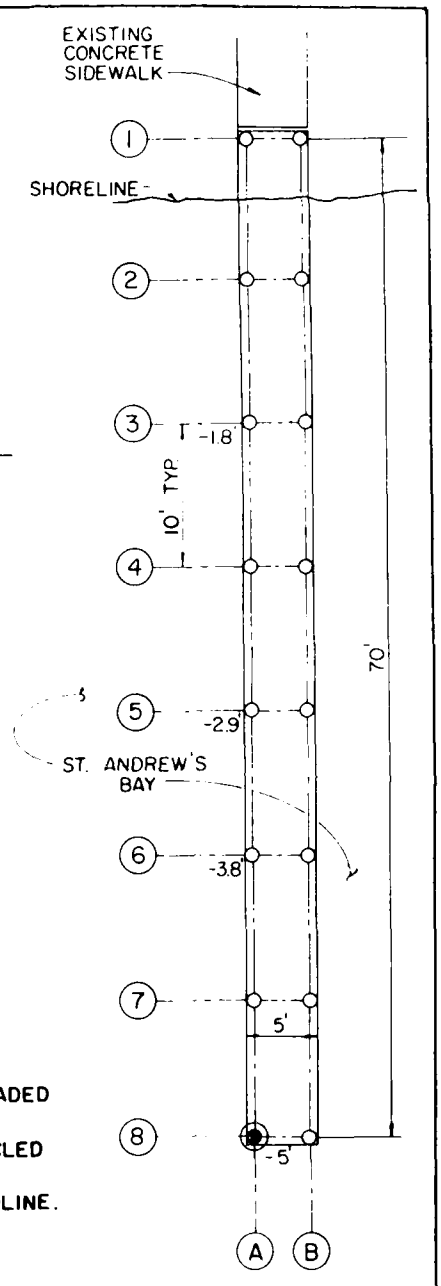
The pier is structurally sound and able to continue in its present function.

4.5.4 Recommendations

Pier 295 should be included in a regular inspection program where all timber structures are examined every three years.



TYPICAL SECTION
SCALE: 1" = 30'



LEGEND

- ● LEVEL II EXAMINATION PERFORMED ON SHADED PILES.
- ◉ LEVEL III EXAMINATION PERFORMED ON CIRCLED PILES.
- -6' SOUNDINGS: DISTANCE FROM M.L.W. TO MUDLINE.

GRAPHIC SCALE		
0 5 10 20 SCALE IN FEET	OGLETREE ENGINEERING INC. CORPUS CHRISTI, TEXAS	CHESAPEAKE DIVISION NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON, D.C. NAVAL COASTAL SYSTEMS CENTER PANAMA CITY, FLORIDA PIER 295

FIG NO 8

PHOTO 17

Pier 295, showing appearance of substructural connections and framing.

PHOTO 18

Pier 295, Pile 8A, showing appearance of cleaned timber pile and plugged core extraction hole.

4.6 PIER 227

4.6.1 Description

Pier 227 is a pedestrian timber structure supported by 12 CCA treated piles. The pier, 55 feet long and 5 feet wide, is in Alligator Bayou on the west end of Bulkhead 146 (See Figure 9 and Photo 19).

4.6.2 Observed Inspection Condition

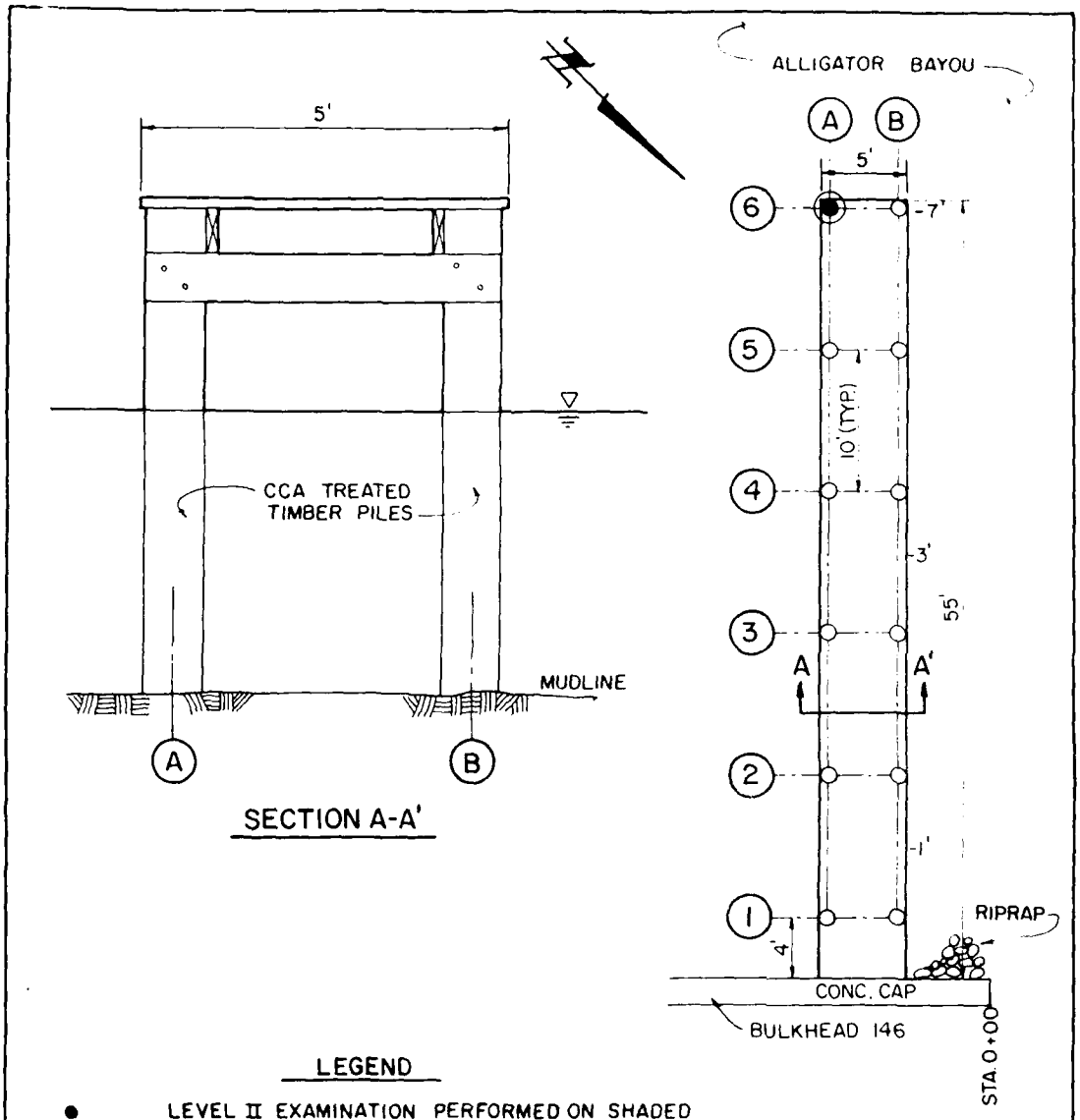
All timber components and connecting hardware are in excellent condition (See Photo 20). No sign of significant decay or marine borer activity was detected at any structural member. Untreated timbers forming a fender system were decaying.

4.6.3 Structural Condition Assessment

The pier is structurally sound and able to continue in its present function.

4.6.4 Recommendations

Pier 227 should be included in a regular inspection program where all timber structures are examined every three years.



LEGEND

- ● LEVEL II EXAMINATION PERFORMED ON SHADED PILES.
- ◉ LEVEL III EXAMINATION PERFORMED ON CIRCLED PILES.
- -6' SOUNDINGS: DISTANCE FROM M.L.W. TO MUDLINE.

GRAPHIC SCALE		
0 5 10 20 SCALE IN FEET	OGLETREE ENGINEERING INC CORPUS CHRISTI, TEXAS	CHESAPEAKE DIVISION NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON, D.C. NAVAL COASTAL SYSTEMS CENTER PANAMA CITY, FLORIDA PIER 227

FIG. NO. 9

PHOTO 19

Pier 227, showing overall view.

PHOTO 20

Pier 227, showing deterioration of untreated timber and excellent condition of CCA treated pile.

4.7 MONORAIL 224

4.7.1 Description

Monorail 224 is a lifting mechanism at the north end of Bulkhead 146, supported by the bulkhead on one end and by two timber piles in the water (See Figure 10).

4.7.2 Observed Inspection Conditions

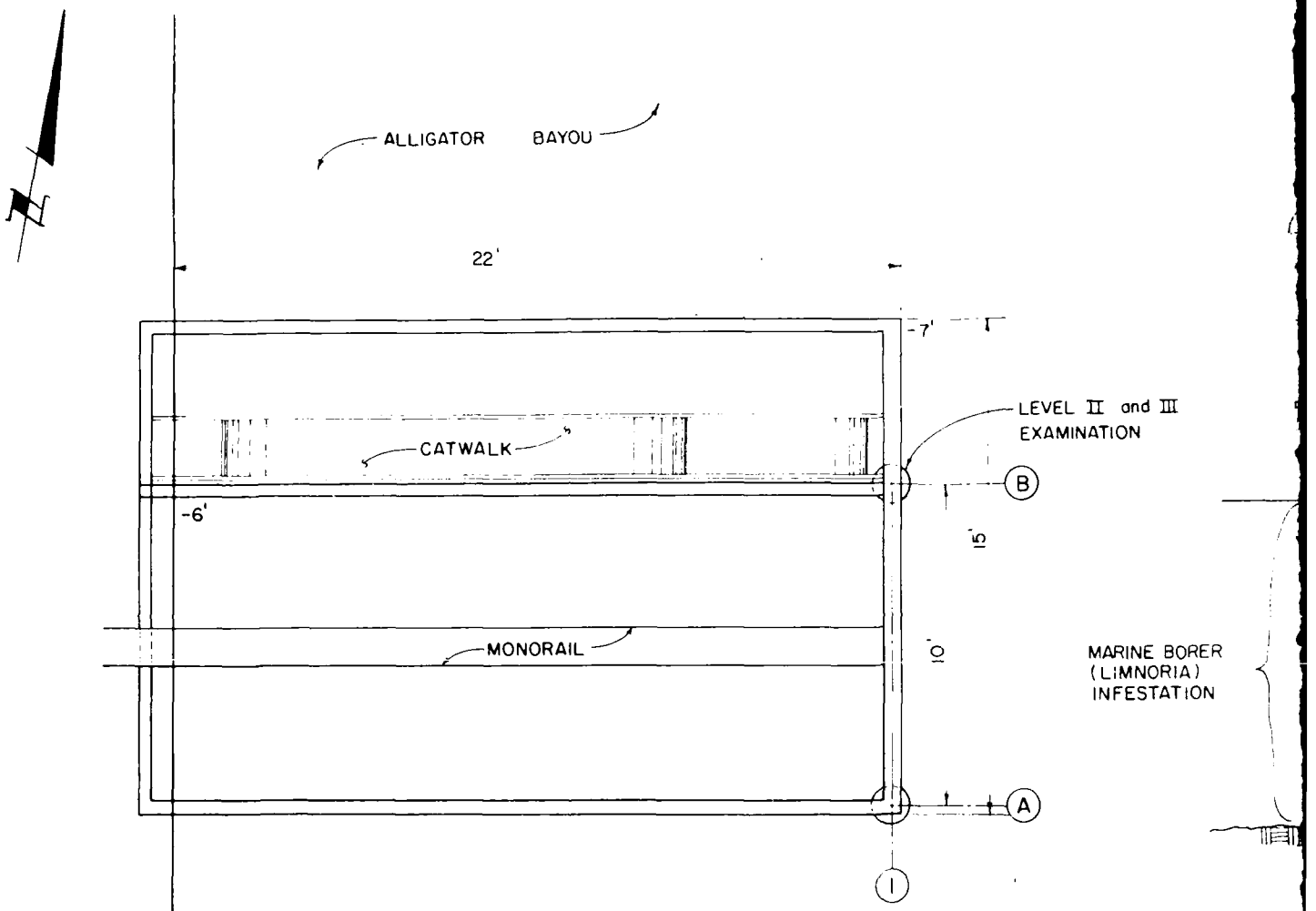
Both timber piles were infested with marine borers (Limnoria). The damage was limited to the surface and severe loss of section had not occurred (See Photo 21). The boring organisms appeared to be extremely active and the condition of the timber piles is expected to deteriorate rapidly. Above the waterline the structural connection from the timber piles to the steel superstructure was corroded but structurally sound (See Photo 22).

4.7.3 Structural Condition Assessment

The monorail piles have not been significantly reduced in cross sectional area, and reducing the structures's capacity based on the condition of the piling is not warranted.

4.7.4 Recommendations

Marine borer attack on the two timber piles should be promptly arrested before structural damage becomes significant. Flexible barrier wraps, such as Pile-Gard, can be installed on the piles. These barrier wraps cut off the oxygen supply to the timber, killing existing borers and preventing further infestation. Barrier wraps could be installed on these two piles by Navy personnel. Cost for this installation would be approximately $1,000. (Due to the small size and simplicity of this repair, "in-house" diving personnel could perform this work economically.)

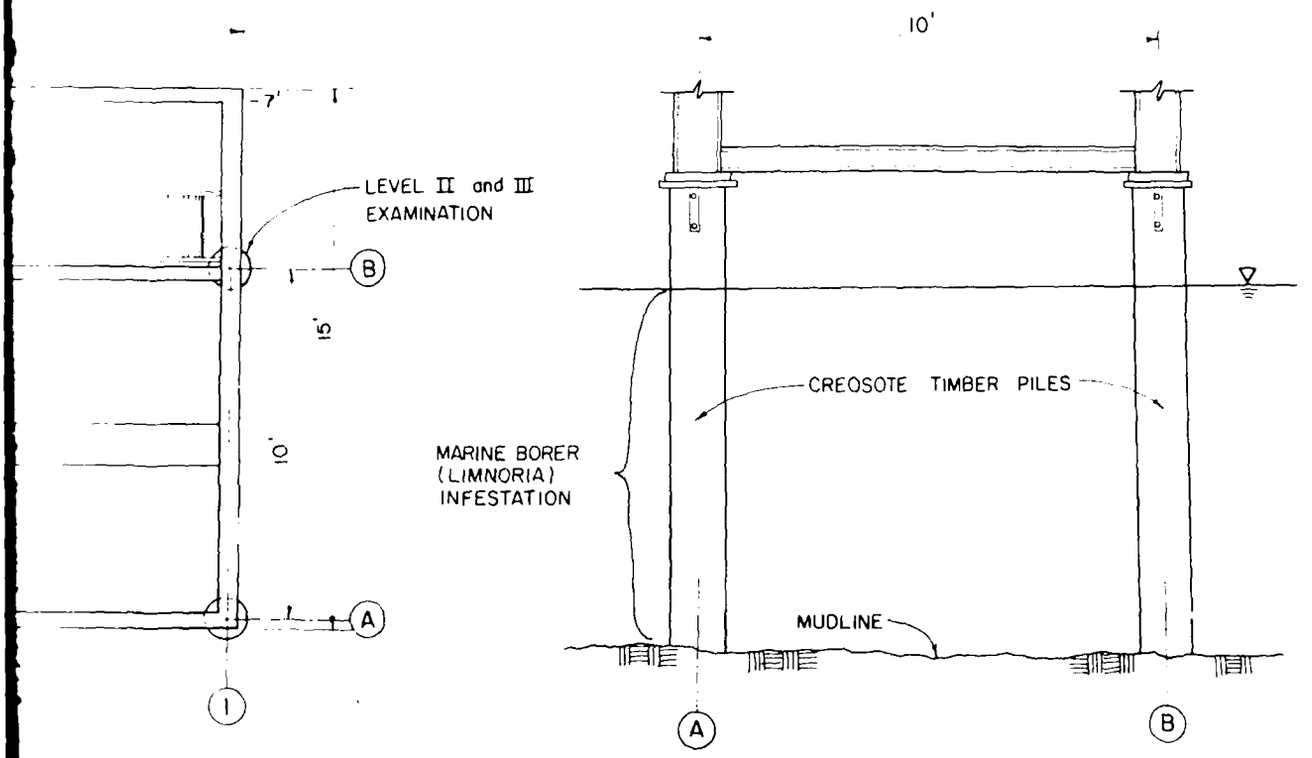


PLAN VIEW

GRAPHIC SCALE

0 1 2 4

SCALE IN FEET



SECTION A
SCALE 1" = 30'

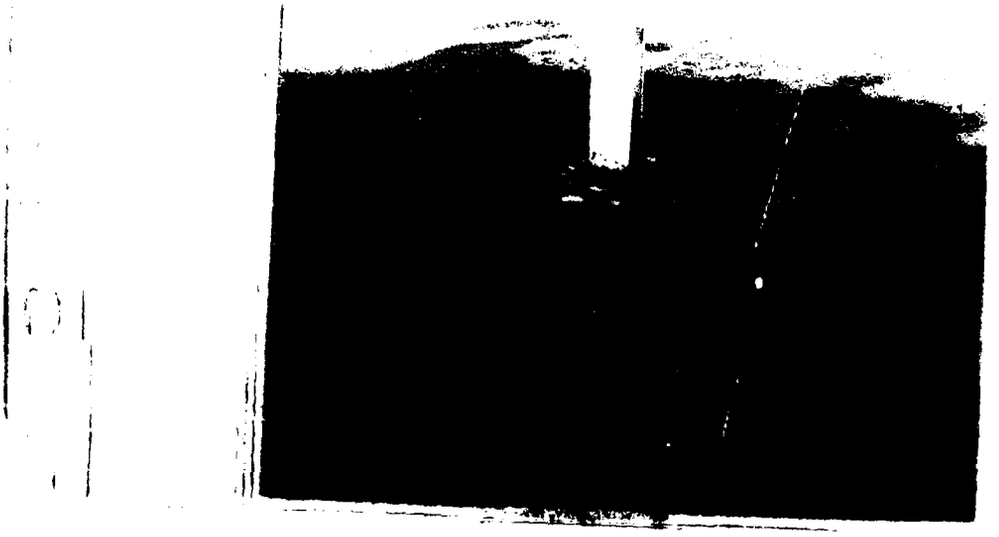
GRAPHIC SCALE			
0 1 2 4 8 SCALE IN FEET	OGLETREE ENGINEERING INC. CORPUS CHRISTI, TEXAS	CHESAPEAKE DIVISION NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON, D.C.	
		NAVAL COASTAL SYSTEMS CENTER PANAMA CITY, FLORIDA MONORAIL 224	FIG NO. 10

PHOTO 21

Monorail 224, showing extraction of timber core.

PHOTO 22

Monorail 224, showing connection of steel superstructure to timber pile.



4.8 PIER 170

4.8.1 Description

Pier 170 is a covered timber and steel structure in a freshwater pond used for underwater testing. Timber and steel substructural members are supported by 18 creosote treated timber piles (See Figure 11).

4.8.2 Observed Inspection Conditions

The underwater portion of the pier was found to be in good condition (See Photo 23). The pond water is probably not sufficiently saline for marine borers to exist, and no significant fungal decay was detected. Above the waterline, top rot was observed in the exposed outer piles (See Photo 24). The stringers supporting the deck were severely corroded in some areas, particularly toward the end of the pier.

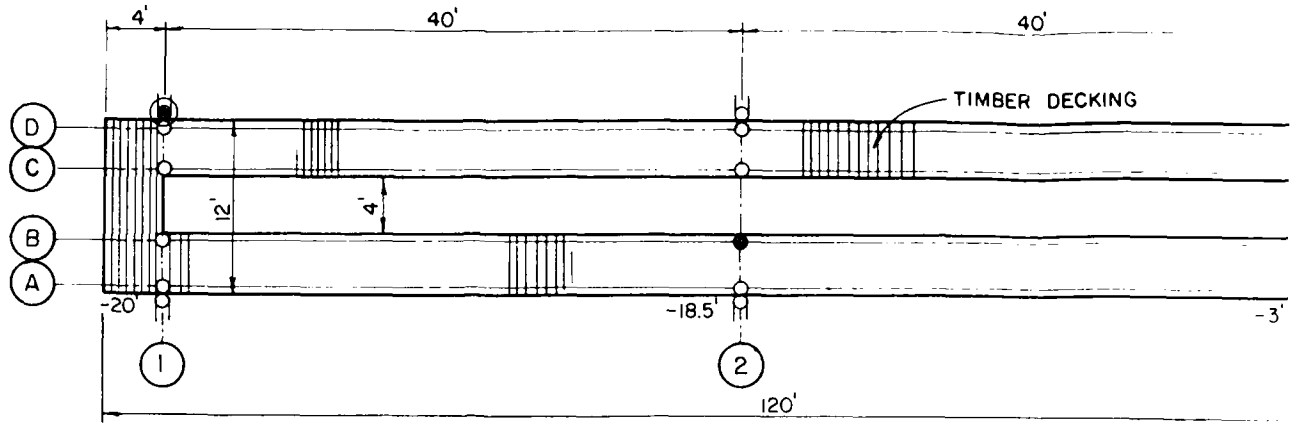
4.8.3 Structural Condition Assessment

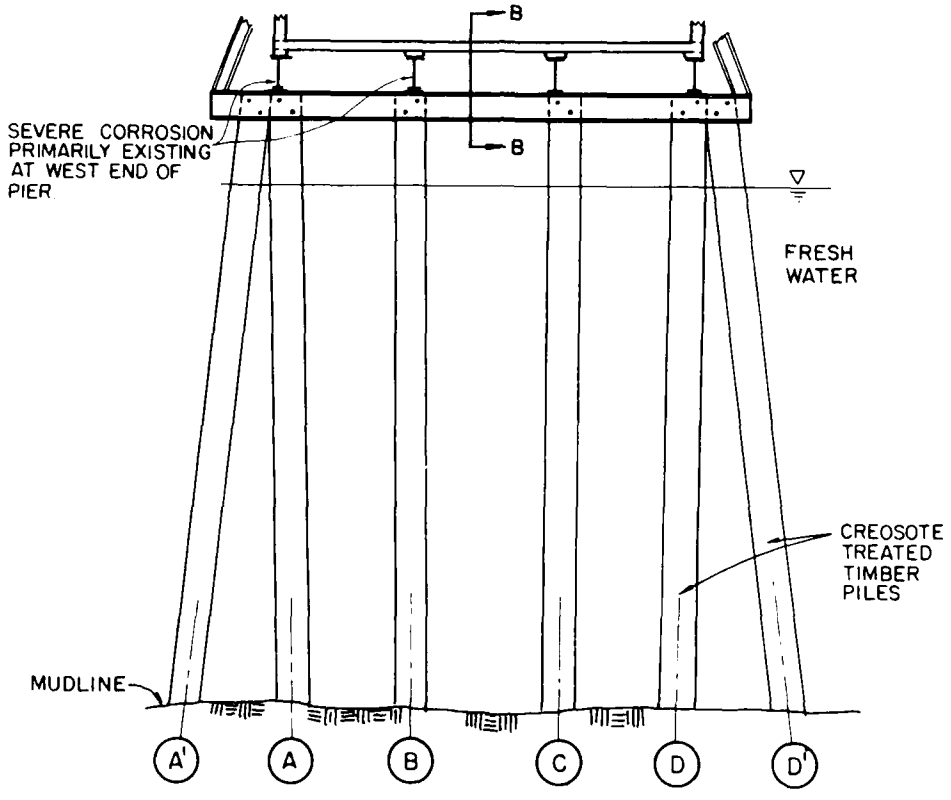
The overall structural condition of Pier 170 is good. The only significant deterioration is visible above the waterline, and does not warrant altering the pier's function at this point, considering the relatively light load carrying requirements.

4.8.4 Recommendations

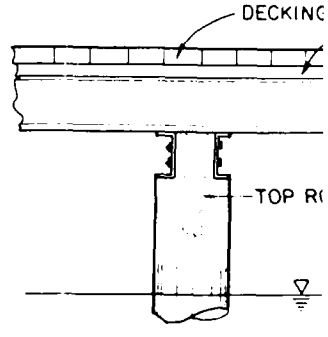
Fungal decay in the pile tops should be treated. The recommended procedure is to remove the soft, decayed wood, fill the void with epoxy grout or another appropriate filler material, and seal the top with sheet metal or a liquid sealer to prevent moisture penetration.

The corroded I beam stringer should be sandblasted, primed and re-coated. Estimated cost to perform this work is $6,000 (See Appendix, Cost Estimate Calculations).





SECTION A

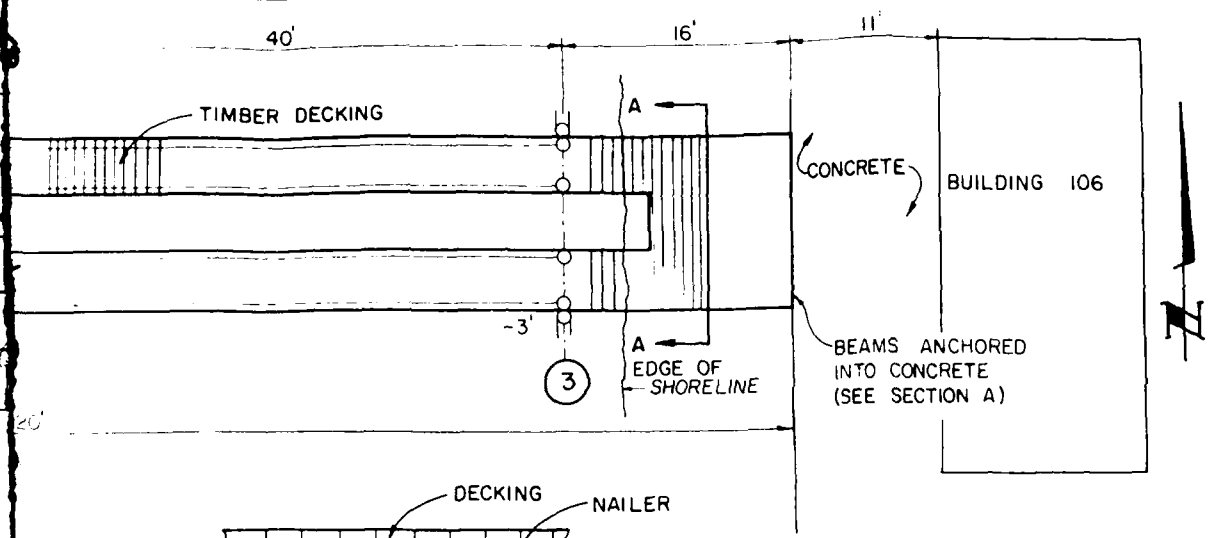


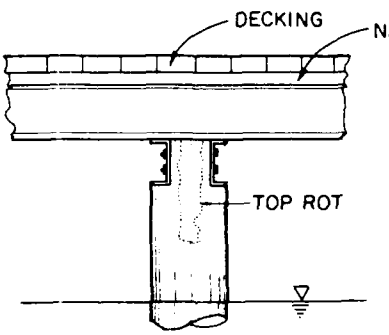
SECTION B-B'

GRAPHIC

0 5

SCALE IN





SECTION B-B'

LEGEND

- ● LEVEL II EXAMINATION PERFORMED ON SHADED PILES.
- ◉ LEVEL III EXAMINATION PERFORMED ON CIRCLED PILES.
- -4' SOUNDINGS: DISTANCE FROM M.L.W. TO MUDLINE.

CREOSOTE TREATED TIMBER PILES

GRAPHIC SCALE			
0 5 10 20 SCALE IN FEET	OGLETREE ENGINEERING INC CORPUS CHRISTI, TEXAS	CHESAPEAKE DIVISION NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON, D.C.	
		NAVAL COASTAL SYSTEMS CENTER PANAMA CITY, FLORIDA PIER 170	FIG. NO 11

PHOTO 23

Pier 170, Pile 3D, showing timber surface and plugged core extraction hole.

PHOTO 24

Pier 170, Pile 2A, showing typical "top rot".

4.9 PONTOON BARGE

4.9.1 Description

The Pontoon Barge is located in the fresh water pond with Pier 170. The barge is also used as a staging platform for conducting underwater tests. Flotation is provided by 12 rectangular steel pontoons. Steel thickness measurements indicate original thickness of 1/8" (See Figure 12).

4.9.2 Observed Inspection Conditions

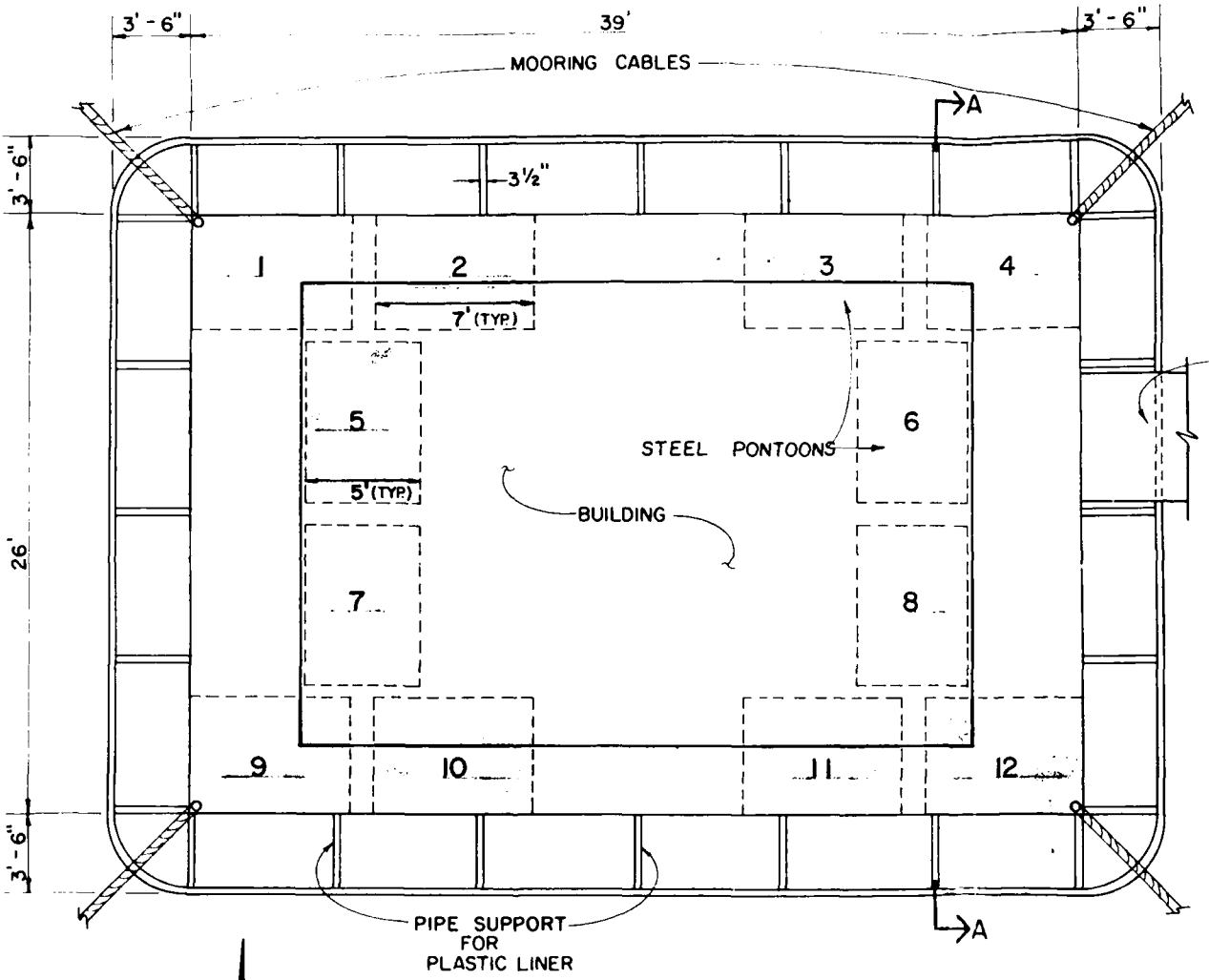
The flotation of the barge is threatened by corrosion pits in the steel pontoons. Overall section losses of steel are insignificant, in fact, paint is intact on most of the steel. However, concentrated pitting has penetrated completely through the steel in at least one location and very nearly penetrated numerous other locations (See Photos 25 and 26).

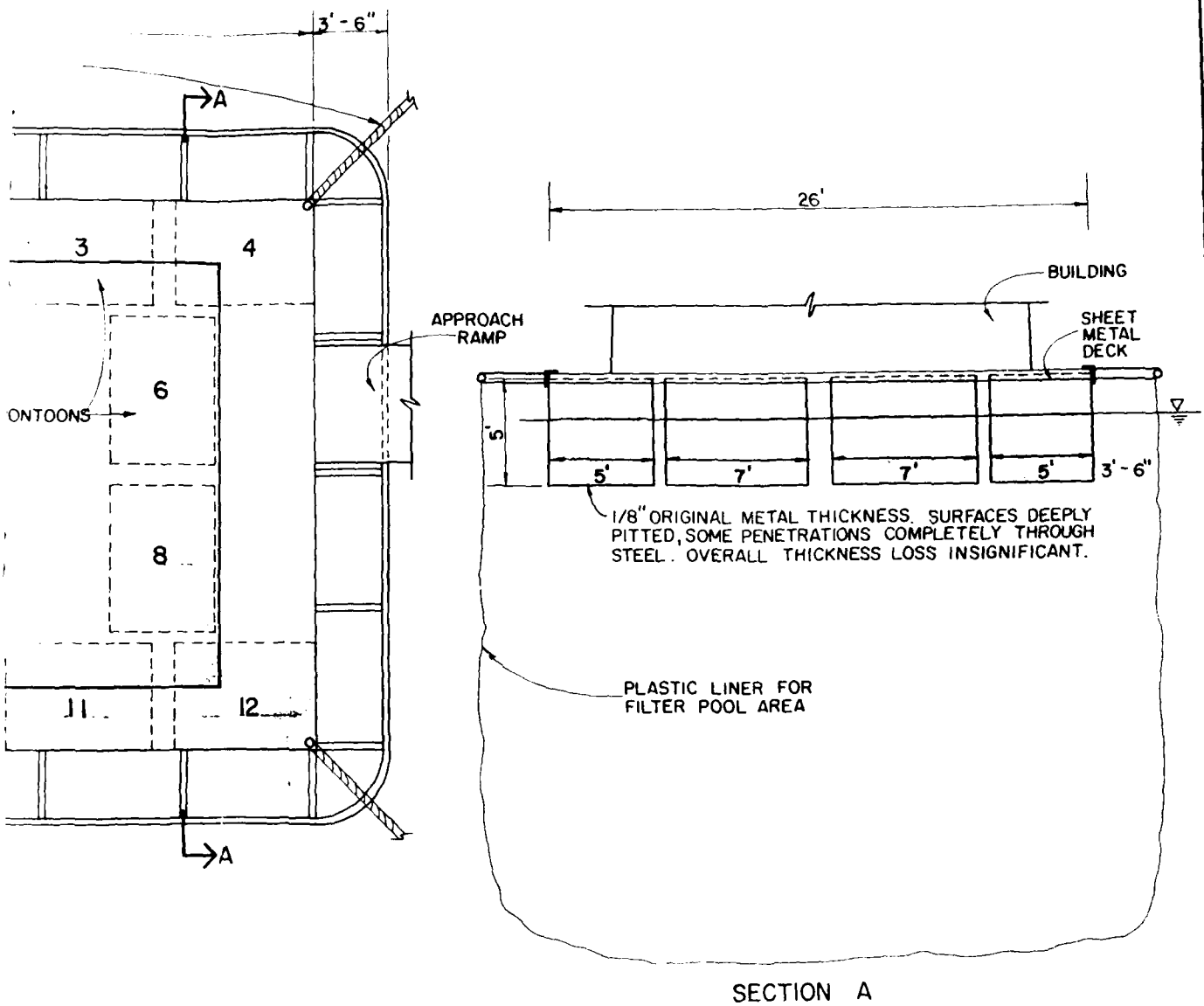
4.9.3 Structural Condition Assessment

Structurally, the barge is in good condition. Corrosion pits penetrating the steel pontoons are causing leaks which will become a rapidly increasing problem.

4.9.4 Recommendations

Flotation can be preserved by injection of an expansive water insensitive foam into the pontoons. This project should include cutting access ports in the pontoons and removing moisture and deleterious material before application of the foam. The steel pontoons would then serve as a form, or mold, for flotation provided by the foam, and future corrosion penetrations would be less significant. Estimated cost to perform this repair is $28,800 (See Appendix, Cost Estimate Calculations).


3' - 6"
39'
3' - 6"
MOORING CABLES
A
3' - 6"
3½"
1
2
3
4
7' (TYP.)
APPROAC
RAMP
5
6
STEEL PONTOONS
5' (TYP.)
BUILDING
26'
7
8
9
10
11
12
3' - 6"
A
PIPE SUPPORT
FOR
PLASTIC LINER
N
GRAPHIC SCAL
0 1 3 6
SCALE IN FEE



SECTION A

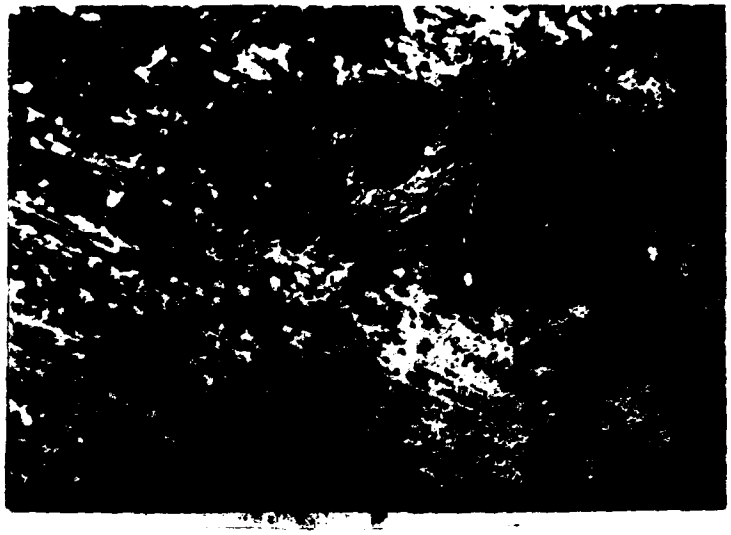
GRAPHIC SCALE	OGLETREE ENGINEERING INC. CORPUS CHRISTI, TEXAS	CHESAPEAKE DIVISION NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON, D.C.	FIG. NO.
0 1 3 6 12 SCALE IN FEET		NAVAL COASTAL SYSTEMS CENTER PANAMA CITY, FLORIDA PONTOON BARGE	12

PHOTO 25

Pontoon Barge, showing corrosion pit completely penetrating steel Pontoon No. 9.

PHOTO 26

Pontoon Barge, close up (1½ x actual size) of corrosion pit nearly penetrating steel Pontoon No. 7. Note intact protective coating immediately adjacent to pit.



4.10 SEAWALL 171

4.10.1 Description

This structure forms the perimeter of the helicopter pad along the shoreline of St. Andrews Bay. The Seawall is 590 feet long, constructed of steel sheet piles with a concrete cap. Lateral support is provided by exterior batter piles which have been concrete encased. The water depth at Seawall 171 is generally less than one foot, so accessible elements of the structure are visible from above the waterline (See Figure 13).

4.10.2 Observed Inspection Conditions

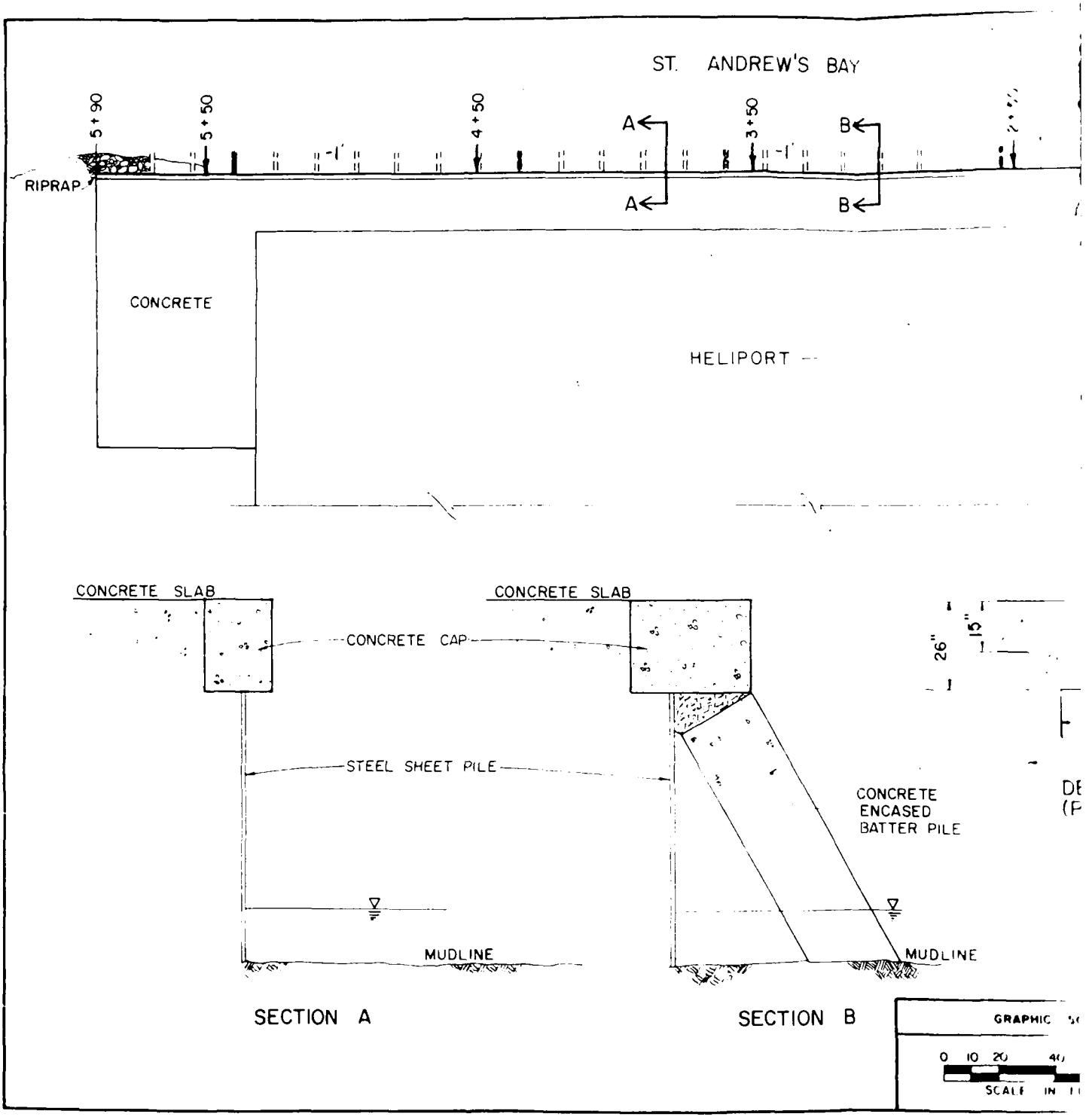
Seawall 171 is in structurally excellent condition. Measurements of the steel sheet piles generally indicated insignificant loss of thickness. The steel surface appears to have been re-coated, generally intact protective coat covers a surface that is rougher and more pitted than new steel (See Photo 27). The lateral support piles had been encased with concrete filled fiberglass forms, presumably to structurally restore capacity lost by corrosion. The encasements appear to be well done, in excellent condition, and functioning as intended (See Photo 28).

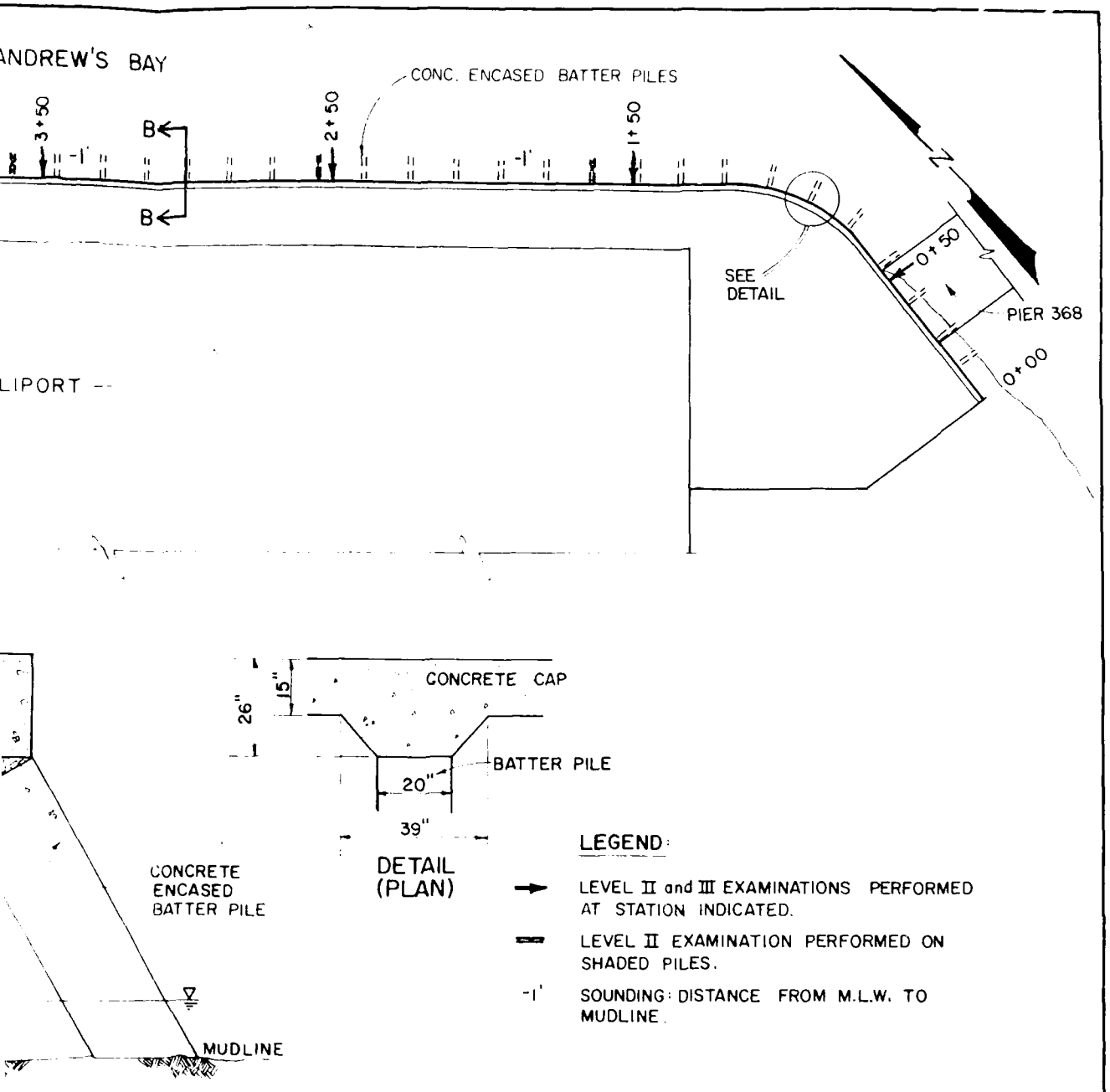
4.10.3 Structural Condition Assessment

Seawall 171 is structurally sound, intact, and in excellent condition.

4.10.4 Recommendations

No immediate maintenance is necessary for Seawall 171 to continue it's present function. The structure should be reinspected in five years.


ST. ANDREW'S BAY
5+90
5+50
4+50
3+50
A
A
B
B
RIPRAP
CONCRETE
HELIPORT
CONCRETE SLAB
CONCRETE SLAB
CONCRETE CAP
STEEL SHEET PILE
MUDLINE
MUDLINE
CONCRETE ENCASED BATTER PILE
26"
15"
SECTION A
SECTION B
GRAPHIC
0 10 20
SCALE IN



SECTION B

LEGEND:

- LEVEL II and III EXAMINATIONS PERFORMED AT STATION INDICATED.
- LEVEL II EXAMINATION PERFORMED ON SHADED PILES.
- -1' SOUNDING: DISTANCE FROM M.L.W. TO MUDLINE.

GRAPHIC SCALE		
0 10 20 40 60 SCALE IN FEET	OGLETREE ENGINEERING INC. CORPUS CHRISTI, TEXAS	CHESAPEAKE DIVISION NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON, D.C. NAVAL COASTAL SYSTEMS CENTER PANAMA CITY, FLORIDA SEAWALL 171

FIG. NO. 13

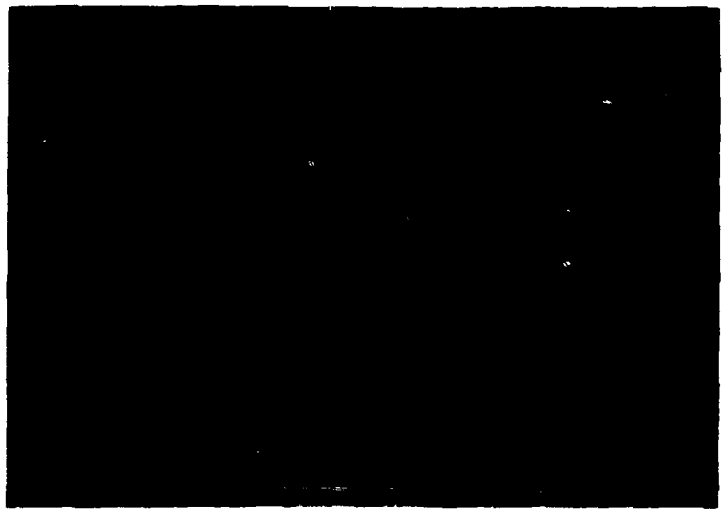
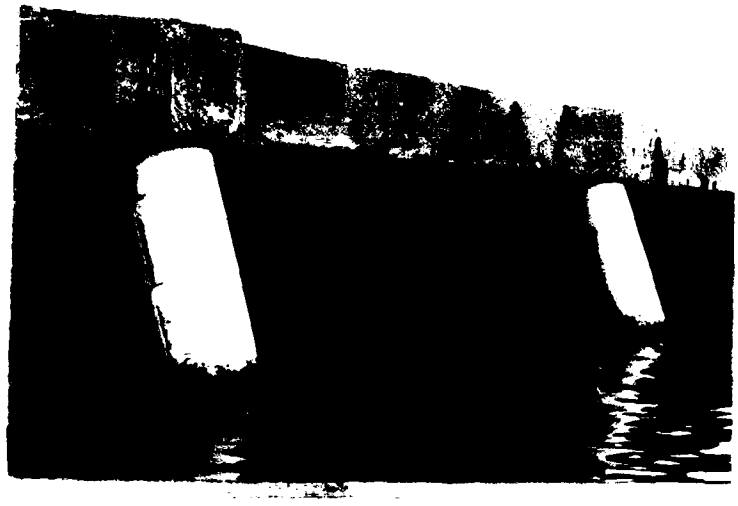


PHOTO 27

Seawall 171, showing rough surface of steel beneath protective coating.

PHOTO 28

Seawall 171, showing encased lateral support piles.



4.11 PIER 368

4.11.1 Description

Pier 368 provides a ramp into St. Andrews Bay for various craft. The structure is pre-cast concrete, supported by 68 square concrete piles (See Figures 14 and 15).

4.11.2 Observed Inspection Conditions

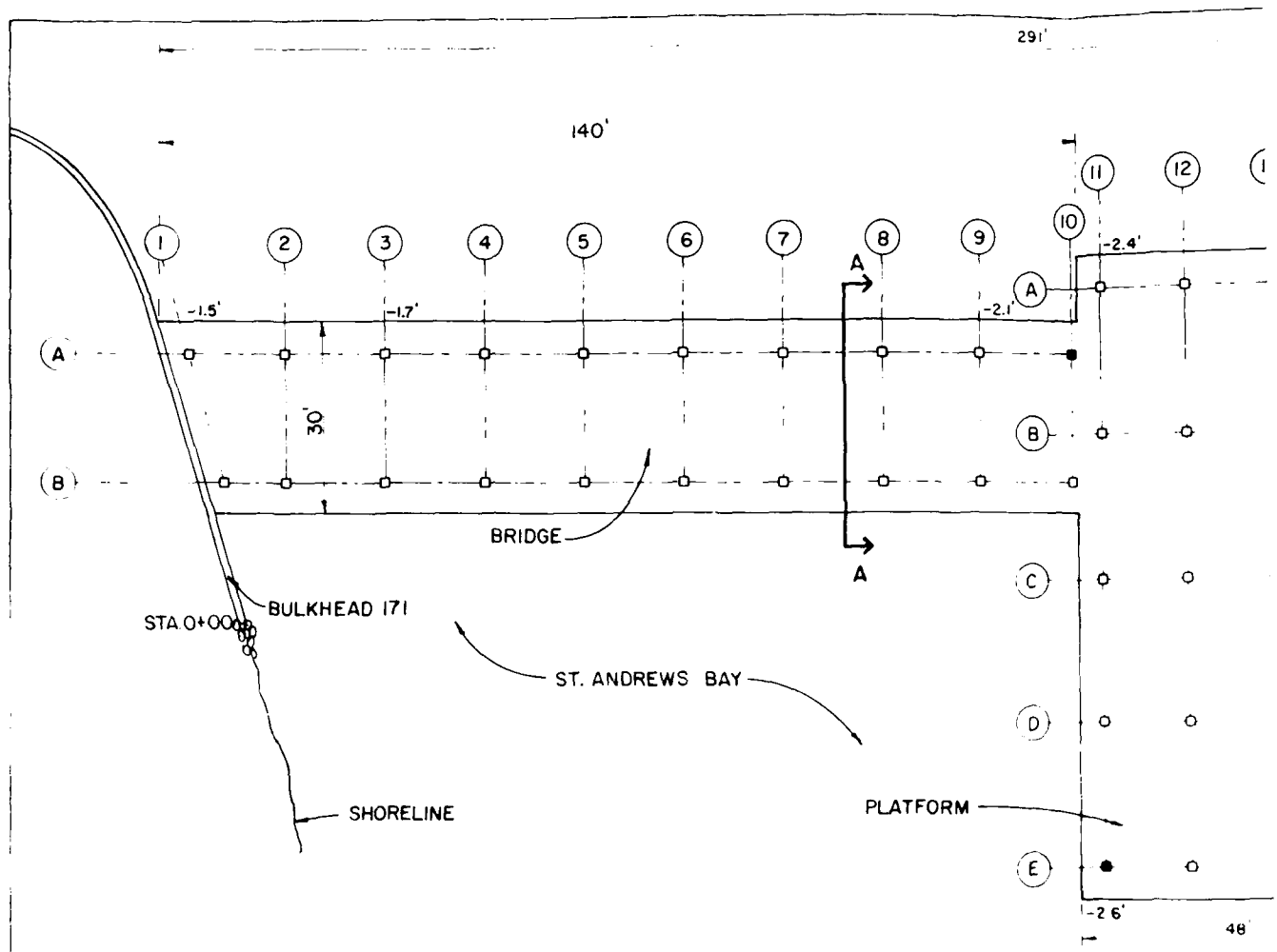
All components of Pier 368 were in excellent condition. Concrete is sound, high quality material. No significant spalling, cracking or other anomalies were detected (See Photos 29 and 30).

4.11.3 Structural Condition Assessment

Pier 368 is structurally sound, in excellent condition, and able to serve it's designed function.

4.11.4 Recommendations

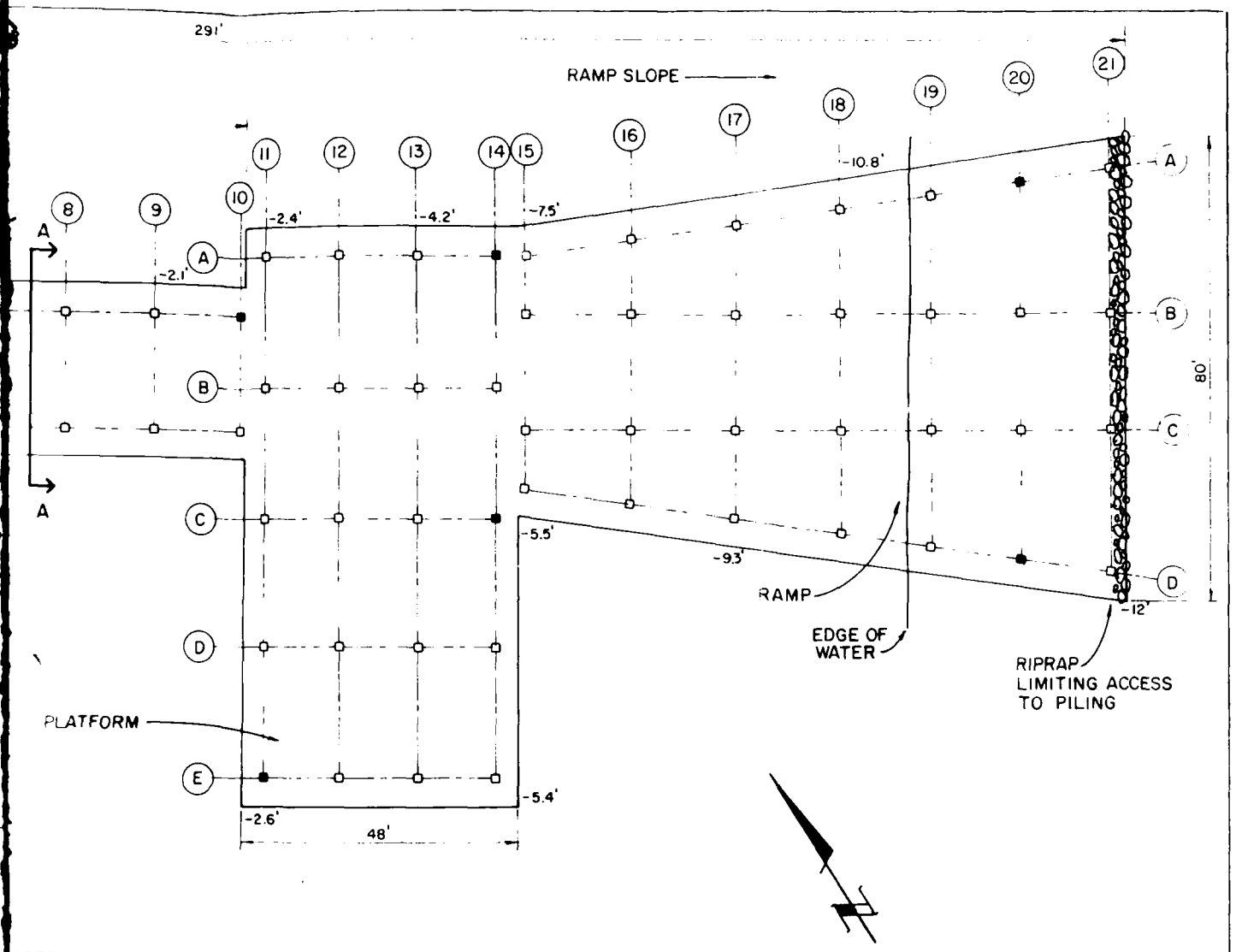
No immediate maintenance needs are evident. The structure should be reinspected in six years to detect development of any potential problems.



LEGEND

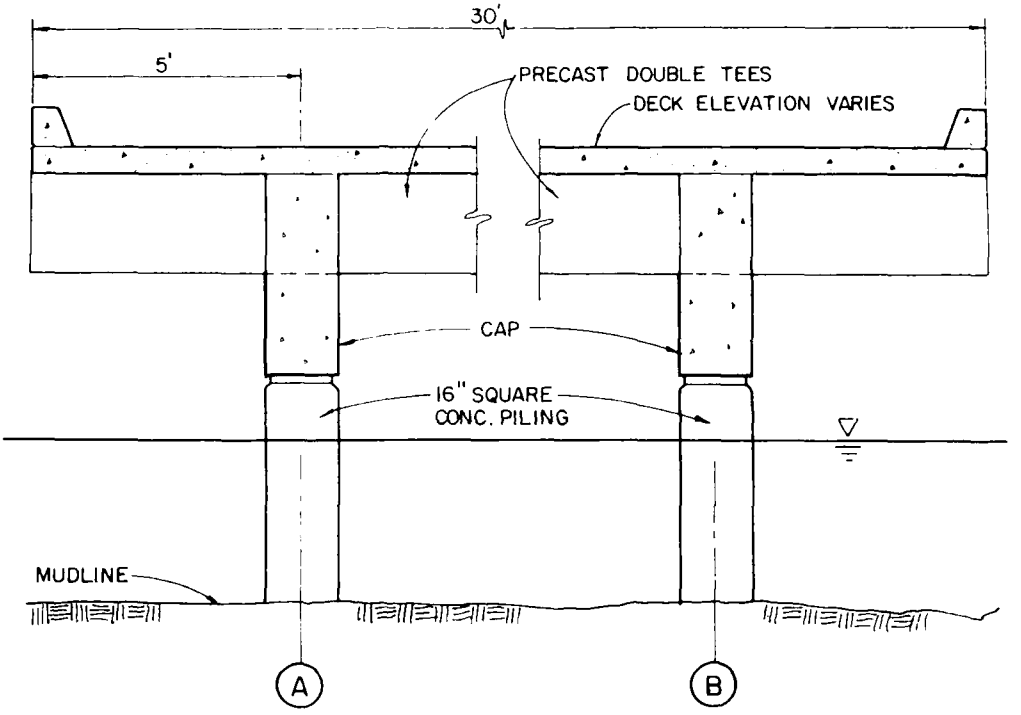
■ LEVEL II EXAMINATION PERFORMED ON SHADED PILES

-9' SOUNDINGS: DISTANCE FROM M.L.W. TO MUDLINE



ADED PILES
DLINE

GRAPHIC SCALE	OGLETREE ENGINEERING INC	CHESAPEAKE DIVISION NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON, D.C.	
0 10 20 30 SCALE IN FEET	CORPUS CHRISTI, TEXAS	NAVAL COASTAL SYSTEMS CENTER PANAMA CITY, FLORIDA	FIG NO 14
		PIER 368	



TYPICAL SECTION 'A'

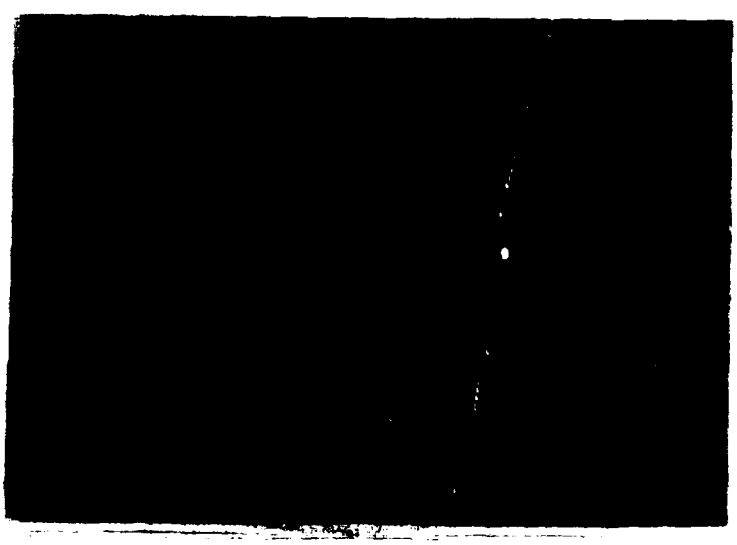
GRAPHIC SCALE		
0 1 2 3 SCALE IN FEET	OGLETREE ENGINEERING INC CORPUS CHRISTI, TEXAS	CHESAPEAKE DIVISION NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON, D.C. NAVAL COSTAL SYSTEM CENTER PANAMA CITY, FLORIDA PIER 368 — FIG NO 15

PHOTO 29

Pier 368, Pile 20D, showing cleaned pile to cap intersection.

PHOTO 30

Pier 368, showing intersection of concrete double tee and cap.



4.12 LANDING CRAFT RAMPS 1 AND 2

4.12.1 Description

These ramps provide hydrofoil access to and from St. Andrews Bay. They consist of concrete slabs on grade sloping into the water with concrete riprap for erosion prevention at the waterline (See Figure 16).

4.12.2 Observed Inspection Conditions

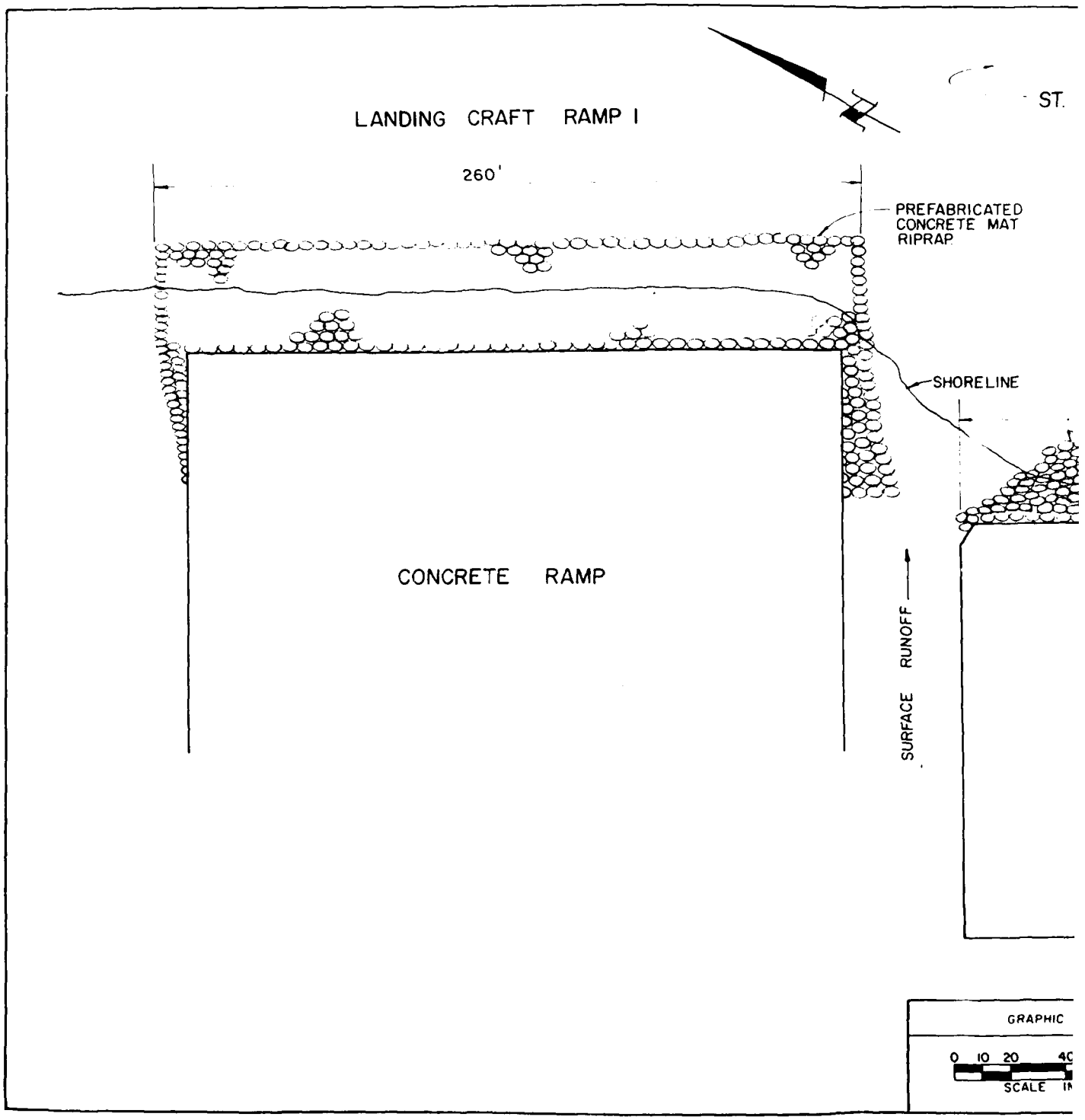
Landing Craft Ramps 1 and 2 are in good condition. Ramp 1 is new and no problems were detected. Concrete is sound, high quality material, and waterline riprap appears to be well placed and effective (See Photo 31). Ramp 2 is also structurally sound, but the effects of shoreline erosion and surface runoff were more evident (See Photo 32). These problems appear to be minor and controllable by occasional riprap maintenance and replacement.

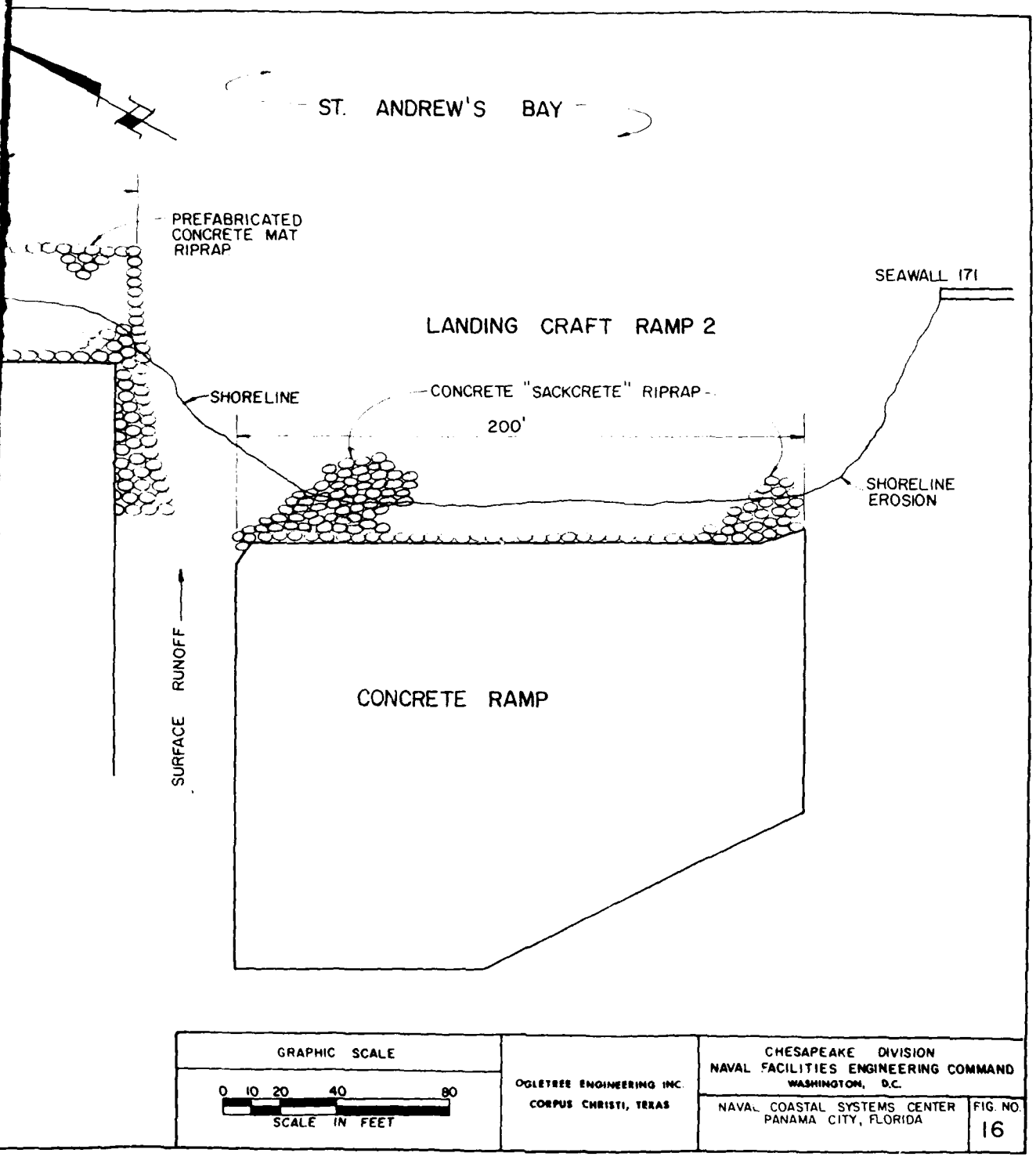
4.12.3 Structural Condition Assessment

Both Landing Craft Ramps are in good condition and able to serve their intended function.

4.12.4 Recommendations

No immediate maintenance needs were evident. The primary potential problem at the Landing Craft Ramps is erosion from surface runoff, shoreline wave and tidal action, and washouts caused by approaching hydrofoil craft. The recommended method for erosion control is placement of prefabricated concrete mats, such as Armorflex. These mats have been utilized with apparent effectiveness at Ramp 1.


LANDING CRAFT RAMP I
260'
PREFABRICATED CONCRETE MAT RIPRAP
SHORELINE
CONCRETE RAMP
SURFACE RUNOFF
ST.
GRAPHIC
0 10 20
SCALE



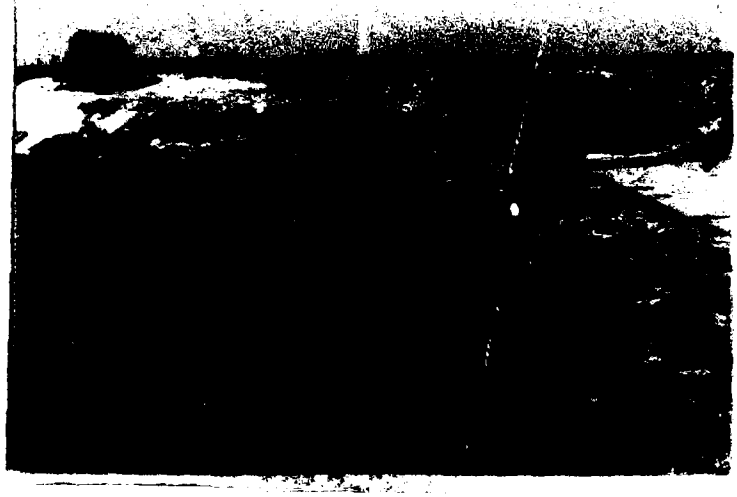
GRAPHIC SCALE	OGLETREE ENGINEERING INC. CORPUS CHRISTI, TEXAS	CHESAPEAKE DIVISION NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON, D.C.	FIG. NO.
0 10 20 40 80 SCALE IN FEET		NAVAL COASTAL SYSTEMS CENTER PANAMA CITY, FLORIDA	16

PHOTO 31

Landing Craft Ramp 1, showing well placed concrete mat riprap.

PHOTO 32

Landing Craft Ramp 2, showing minor effects of shoreline erosion.



APPENDICES

TABLE OF CONTENTS FOR APPENDIX

COST ESTIMATE CALCULATIONS

PIER 136

1. Demolish and remove existing pier.
   Estimated lump sum..... $ 20,000.00

2. Replace Existing Pier

   Piles 36 treated timber piles, estimated average length 40'.

   Cost in place = $20.00/LF
   36 piles x 40' length x 20.00/LF = $28,800

   Framing: subdeck and bracing
   Cost in place = $2,000/MBF
   30 MBF x $2,000/MBF = 60,000

   Concrete: deck and curb
   Cost in place = $400/CY
   60 CY x $400/CY = 24,000

   Demolition 20,000

   Contingencies and Miscellaneous 17,200

   Total Estimated Cost..... $150,000

3. Structural rehabilitation of existing pier.
   36 piles, average encasement length = 14 LF

   Estimated cost to remove old concrete, clean pile, excavate, install reinforcing steel, form and place concrete = $200/LF

   36 piles x 14 LF x 504 LF x $200/LF..... $100,800

4. Replace Pier 136 with timber structure with comparable work area and capacity for loaded pickup truck, narrower approach width.

Piles: (similar to original)	$ 28,800
Framing: 25 MBF x $2,000/MBF	50,000
Contingencies and Miscellaneous	11,200
Demolition	20,000
Total Estimated Cost.....	$110,000

5. Replace Pier 136 with timber structure consisting of work platform and pedestrian approachway.

Piles: 31 @ 35' average length = 1,085 LF	
1,085 LF x $20/LF in place	$ 21,700
Framing: 18 MBF x $2,000/MBF	36,000
Contingencies and Miscellaneous	9,300
Demolition	20,000
Total Estimated Cost.....	$ 87,000

BULKHEAD 146

Locate and patch holes in steel sheet piles

Virtually all of the cost of this work is labor. Only minor material costs are required, (steel patches, welding rods, grout). Use of in-house Navy diving personnel and trainees is recommended. However, estimate is for commercial diving company.

2,100 LF of bulkhead to be cleaned and patched. Assume 4 man crew, 2 divers and 2 tenders, with equipment, including waterblaster, at a rate of $1,500/day and a production rate of 60 LF/day.

2,100 LF ÷ 60 LF/day x $1,500/day..... $ 52,500.00

BULKHEAD 358

818 LF to be cathodically protected.

Estimated cost for impressed current cathodic protection system, including continuity by connections between all sheet piles, 2 EA 200A rectifer, 80 anodes in place..... $ 75,000

Note: Extensive testing and design is essential for final design and cost estimate of a cathodic protection system.

MARINA 311

Stabilize slope with manually placed concrete bags.

Material:

Total length of slope at concrete slab is 123 feet.

Estimated quantity of concrete:	
500 sacks @ $4/sack	$ 2,000
Labor: estimated lump sum	3,000
Total Estimated Cost.....	$ 5,000

MONORAIL 224

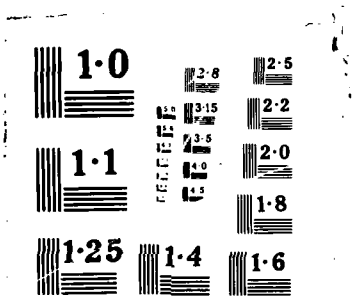
Install flexible PVC barrier wraps

Material:

Total encased length, including burial and overlaps, 30 LF @ $10.00/LF	$ 300

AD-A168 601 UNDERWATER FACILITIES INSPECTIONS AND ASSESSMENTS AT NAVAL COASTAL SYSTEM..(U) OGLETREE ENGINEERING INC CORPUS CHRISTI TX JUN 85 CNES/NAVFAC-FPO-1-85(17) 2/2

UNCLASSIFIED N62477-85-D-0003 F/G 13/2 NL


1·0
1·1
1·25
2·8
3·15
3·5
4·0
4·5
2·5
2·2
2·0
1·8
1·4
1·6

Monorail 224 Cont'd.

Labor:

A diver/tender team could perform this job in one hour. Due to the small size of the project, allow one day. 700

Total Estimated Cost..... $ 1,000

PIER 170

Repair top rot and paint steel I-beams.

Material:
Paint, grout, and blasting sand. $ 1,000

Labor: Labor intensive project 5,000

Total Estimated Cost..... $ 6,000

PONTOON BARGE

Fill existing pontoons with liquid foam.

Material:

Pontoons are 5' x 5' x 7' = 175 FT^3
Flotation volume achieves 5 FT^3/GAL
175 FT^3 ÷ 5 FT^3/GAL x $40/GAL x 12 pontoons $ 16,800

Pontoon Bridge Cont'd.

Labor:

Crew with tools to cut access ports, plug holes, mix and apply foam.

1 day/pontoon @ $1,000/day	$ 12,000
Total Estimated Cost.....	$ 28,800

STRUCTURAL CALCULATIONS

EXISTING DEAD LOAD, PIER 136

SPAN = 15' x 10' SPACING = 150 SQ. FT

CONCRETE DECK LOAD:

6" x 150 SQ. FT. x 1½" = 75 CU. FT.

75 CU. FT. x 150 #/CU. FT = 11 KIPS

TIMBER FRAMING LOAD:

1 MBF / PILE x 5K / MBF = 5 KIPS

ESTIMATED MAXIMUM DEAD LOAD/PILE:

11 KIPS/PILE + 5 KIPS/PILE = 16 KIPS/PILE

OK.

STRUCTURAL CALCULATIONS

SAFE LOADS FOR TIMBER COLS

$L/d \leq 11$ $\quad P = A \cdot C$

$11 < L/d < K$ $\quad P = A \cdot C\left[1 - \frac{1}{3}\left(\frac{L/d}{K}\right)^4\right]$

$L/d \geq K$ $\quad P = 3.29 \times 10^{-4} \cdot E \cdot A / (L/d)^2$

P = SAFE LOAD (KIPS) (I.E. MAXIMUM SAFETY FACTOR AGAINST BUCKLING = $\frac{\pi^2 EI}{L^2}$)

A = CROSS SECTIONAL AREA (IN^2) USING EFFECTIVE d FOR ROUND POLE $\frac{\pi d^2}{4}$ $78.5\ IN^2$

E = MODULUS OF ELASTICITY ($\#/IN^2$), $1.6 \times 10^6\ \#/IN^2$

L = UNSUPPORTED LENGTH (IN)

d = LEAST DIMENSION (IN) USED EQUIVALENT SQUARE TIMBER DIMENSION FOR ROUND COLUMN $\bar{A} = 486\ IN$

L/d = SLENDERNESS RATIO (IN/IN)

I = MOMENT OF INERTIA (IN^4), $I = \frac{\pi d^4}{64} = 490.87\ IN^4$ d = DIAMETER

C = SAFE UNIT COMPRESSIVE STRESS PARALLEL TO THE GRAIN $C = 875\ \#/IN^2$

K = SLENDERNESS RATIO CONSTANT FOR GIVEN SPECIES, GRADE AND CONDITION OF SERVICE; VALUE OBTAINED IS THE MINIMUM VALUE COLUMN WILL BEHAVE AS AN EULER COLUMN, FAILURE AS A RESULT OF BUCKLING), WHEN $P/A = 2/3$ $K = \pi/2\sqrt{E/C}$

$K = 30$

SAMPLE CALCULATION: FIND SAFE LOAD FOR COLUMN L = 30'

$K = \pi/2\sqrt{E/C} = \pi/2\sqrt{1.6 \times 10^6 / 875} = 30$

$L/d = (30 \times 12)/8.96 = 40.63$

$\therefore P = 3.29 \times 10^{-4} E \cdot A/(L/d)^2$

$= 3.29 \times 10^{-4}(1.6 \times 10^6)(78.5)/(40.63)^2$

$P = 25\ KIPS$

TABLE OF SAFE LOADS FOR VARIOUS UNSUPPORTED LENGTHS

UNSUPPORTED LENGTH (L)	SLENDERNESS RATIO (L/d)	SAFE LOAD (P IN KIPS)
10' = 120"	13.54	67.7
20' = 240"	27.08	51.8
30' = 360"	40.63	25.0

REFERENCES: WOOD ENGINEERING, GERMAN GURFINKEL
SOUTHERN PINE MANUEL OF STANDARD WOOD CONSTRUCTION,
SOUTHERN PINE ASSOCIATION

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